

October 10, 1960

# Aviation Week

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Aircraft Tested  
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Support Work

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## Kaylock, 'captive washer' nut gains wide acceptance!

Since its introduction early in 1960, this new Kaylock® lightweight, all-metal self-locking nut with integral free-spinning metal washer has been specified by leading aerospace manufacturers for an increasing number of applications. Separate washers that used to drop off, roll away, and slide into hard-to-get-at places have been eliminated. The danger of short circuits, due to these forgotten washers, also has been eliminated by the new Kaylock HW14 nut-washer combination.

**Saves Assembly Time:** Kaylock HW14's cut extra motion required to put washer on bolt. Washer can't drop off during application or removal. Cut time lost looking for wayward washers—(a zero)! Safer, too! Kaylock HW14 "captive washer" nuts employ the same, sure elliptical locking principle to prevent vibration hazards. The Kaylock HW14 is a development of Kaynar Mfg. Co., Inc., world's oldest and largest manufacturer of lightweight, all-metal self-locking nuts. For complete details, call your nearest Kaylock representative.



The Kaylock HW14 is available in sizes 10-20 (shown above) and in other sizes to 3.

Name of Kaylock HW14 2 and washer given to assembly.

Assembled HW14 2 nut and washer, free spinning washer can't drop off. Only one part to handle instead of two.

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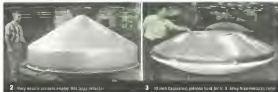
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**GOODYEAR AIRCRAFT**

Plastics in Akron, Ohio, and Lockheed Plant, Burbank, Pennsylvania 2 20-inch Cassegrain antenna

3 10-inch Cassegrain antenna for U.S. Army Hawk missile



2 Many missile antennas employ 20-inch reflector

3 10-inch Cassegrain antenna for U.S. Army Hawk missile





# NOTHING IS TOO FAR OUT.... FOR GRUMMAN TO BE IN



This is a vapor screen photograph of hypersonic Mach 8 flow about a delta wing with underwing cone, taken at Arnold Engineering Development Center tunnel B. Photo was made during Grumman research experiments, partially supported by Air Force Wright Air Development Division Flight Control Laboratory.

Shock pattern is discernable along the shock layer on wing (light area), boundary layer on wing (dark region), and shock layer on body (dark region). Bright white line on underside of wing and body is reflection of light screen.

This photo characterizes the work Grumman is doing in hypersonic aerodynamics. Other efforts at Grumman include continuing design and development work on orbiting observations, interplanetary communication systems, re-entry vehicles and reconnaissance satellites, to name a few.

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**Miniature BeGears**—Army units carry out intricate operations of wheeling, rolling, and envelopment with BeGears precision. Their soldiers are led by "movers" controlled by "directors." BeGears are precision, they form. BeGears—Army units are active in any situation.

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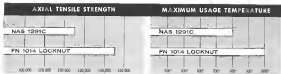
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- Thread form is in accordance with MIL-B-5746, Class 2B
- Forged from A-286 heat and corrosion-resistant steel
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Designed for use at moderate temperatures is the FN 1014M Series, also made of A-286 material, but coated with an approved polyethylene disulfide dry film lubricant. Both FN 1014 and FN 1014M are available in sizes from #4-40 through 1/2"-24 from any SPS sales office or authorized aircraft fastener distributor.

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Monitored TV picture tele-transmitted from F-104 chase plane by TAPCO system at the Air Force Weapons Test Weapons Center



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TAPCO true FM video telemetry systems are built around an exclusive TAPCO circuit design. They utilize a unique system of signal synthesis which combines the advantages of wide-deviation FM modulation with the high-frequency stability of crystal-controlled equipment. The airborne transmitter is of compact modular design, allowing a wide choice of module components, and minimum problems of system integration.

#### APPLICATIONS

TAPCO video telemetry systems are ideal for applications requiring extremely reliable picture transmission and reception. Operations over distances from one to 300 miles is not unusual. These systems are now ready for applications to manned aircraft, drones, missiles, satellites, balloons,

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#### PERFORMANCE

- Video Band Width: Up to 16 megacycles
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TRW can provide complete or partial telemetry systems, including transmitters, receivers, antennas, and the video camera and terminal equipment. Considerable system flexibility is allowed by the wide range of component choices.

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# KNOW YOUR ALLOY STEELS . . .

*This is one of a series of self-instructional articles that will help you learn about alloy steels. This is one of a series of self-instructional articles that will help you learn about alloy steels. This is one of a series of self-instructional articles that will help you learn about alloy steels.*

## Thermal Stress-Relieving of Alloy Steels

In the production of alloy steel bars and parts made of alloy steel, stresses are sometimes set up, and these stresses must be relieved before optimum results can be expected. Two general types of stress-relieving are practiced—thermal and mechanical. In this discussion we shall consider only the former.

There are several important reasons for thermal stress-relieving. Among these are the following:

(1) The first and most fundamental purpose is to relieve residual stresses that might prove harmful in actual service. In the production of quenched and tempered alloy steel bars, residual stresses are usually relieved after the straightening operation. When the bars are subjected to later processing that sets up additional stresses, subsequent stress-relieving may be necessary.

(2) A second major purpose of thermal stress-relieving is to improve the dimensional stability of parts regarding close tolerances. For example, in rough-machining, residual stresses are sometimes introduced, and these should be relieved if dimensional stability is to be assured during the finish-machining.

(3) Thermal stress-relieving is also recommended as a means of restoring mechanical properties (especially ductility) after certain types of cold-working. Moreover, it is required in the "safe-welding" grades of alloy steels after a welding operation has been completed.

Alloy bars are commonly stress-relieved in furnaces. Temperatures under the transformation range are employed, and they are usually in

the area from 850 deg to 1200 deg F. The amount of time required in the furnace will vary, being influenced by grade of steel, magnitude of residual stresses caused by prior processing and mass effect of steel being heated. After the bars have been removed from the furnace, they are allowed to cool in still air to room temperature.

In the case of quenched and tempered alloy bars, the stress-relieving temperature should be about 100 deg F less than the tempering temperature. Should the stress-relieving temperature exceed the tempering temperature, the mechanical properties will be altered.

Items other than bars (parts, for example) can be wholly or selectively stress-relieved. If the furnace method is used, the entire piece is of course subjected to the heat; selective relieving is impossible. However, if a liquid salt bath or induction heating is used, the piece can be given overall relief or selective relief, whichever is desired.

Detailed information about stress-relieving is available through Bethlehem's technical staff. And remember that we can furnish the entire range of AISI standard alloy steels, as well as all carbon grades.

*This series of alloy steel self-instructional articles is now available as a compact booklet, Quick Facts about Alloy Steels. If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.*

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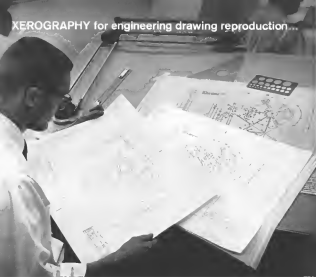


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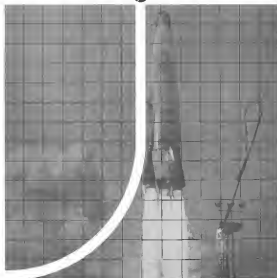
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## EDITORIAL

### Where Do They Stand?

With only 30 days remaining until the presidential election, neither candidate for this high office has seen fit to expand his proposed policies on one of the most important issues governing the future of this country. This issue is its broadest sense a national defense, and includes not only our formal military establishment but also the economic and foreign policies that combine with the military to weave the authentic fabric of our national power and international influence. It certainly must include the critical area of space exploration and use for scientific, commercial and military purposes.

It is ironic that the defense issue has dropped completely from the campaign centers' repertoire of both presidential and vice presidential candidates. In the heat of the mounting conservatism last summer both parties placed strong emphasis on the defense issue in their platforms. Vice President Nixon devoted it of sufficient importance to ask the disapproval of President Eisenhower to accept the stronger defense views of New York's Gov. Nelson Rockefeller. Scarcely both parties picked vice presidential candidates who had not standing records as advocates of stronger national defense.

As the campaign has progressed it has no doubt been encouraging for American citizens to learn that Vice President Nixon is unequivocally opposed to "dead ducks" and that Sen. Kennedy is against economic deprivation. But we suspect that one even more concerned about what these two preferences and their cohorts plan to do about the ongoing influence of the United States in the international arena and the failure to pursue a strong and vigorous national defense policy that feels exploits the technological revolution of the past decade. No amount of campaign strategy can gloss over the fact of this sagging prestige on the basic issues therefore. Even newspaper reader or television viewer can see the results of this almost daily in the pounding of Nikita Khrushchev's fat fist on the United Nations' desk and the Russian entree of the big lie technique that the Soviet chairman has been spouting from the UN sounding board.

At the same time, the validity of defense criticism during the past year has been confirmed by the quiet actions of the Eisenhower Administration during the past months. As quietly as it is possible in the public bowl of Washington, the Administration has been doing the additional defense funds voted by Congress into key development programs. These additional funds were hastily disbursed last summer by President Eisenhower in emergency and were promptly frozen by the Budget Bureau and Defense Department. The President further put himself on record against any increase in the defense program in his now famous "job's book" blast at his defense critics at the Republican convention

in Chicago. As late as last August the Administration stood firm on freezing about \$650 million of the additional funds voted by Congress (AW Aug. 15, p. 38).

Now in the waning weeks of September and the early days of October the same Administration has been freezing not these frozen funds and quietly treading them into the very programs that the critics have been howling about since last January in regarding more funding and higher priority. The roll call of the projects getting these additional funds (AW Aug. 8, p. 21; Sept. 26, p. 25; Oct. 10, p. 36) is the issue in the key points mentioned on the defense critics for at least two months—Polaris, Minuteman, Socrates, Madex, B70, MATS modernization, modernized Army equipment, anti-submarine warfare, Dyna Soar, Skybolt and other key research areas. We certainly agree with Defense Secretary Thomas Gates' observation that the defense budget can no longer be operated within the strictures of an annual budget procedure and must be subject to constant review and change in meet technical and political shifts and opportunities. But we think he also would agree with our observation that it is far better to conduct these reviews in advance of and in anticipation of events and policy shifts rather than far too long after the great facts have become all too evident to the rest of the world.

Actually the defense critics of the Eisenhower Administration have been confirmed in almost every detail of their list of indictment by the Administration's actions in recent weeks. Particular credit should go to the military leaders who had the courage to voice their honest convictions before Congress last spring and to the congressional leaders who believed them and pressed resolutely for stronger emphasis and higher priority for key selected developments in the defense spectrum. In view of this notable action, it is rather surprising to see one of its chief architects, Sen. Lyndon Johnson, the Democratic vice presidential candidate, miss the opportunity to emphasize the results of his work and the startling proof of the validity of his theme.

We suspect that Messrs. Nixon and Lodge may be quietly waiting until this final bookkeeping is completed in the Defense Department and then announce it with considerable fanfare as convincing proof that their party is not unskilled in defense requirements.

In any case, we believe the American voter will approach the polls with more positive conviction after both candidates express themselves clearly on the vital defense issue. It will indeed be a difficult choice of national leadership in the international crisis ahead, open as it neither area fit to develop a vigorous policy and takes a firm stand in this area.

—Robert Hots

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## WHO'S WHERE

### In the Front Office

Charles G. Gellinger, president and a dozen California Eastern Airlines Inc. employees. Mr. Gellinger is a member of the company's board of directors.

United Aircraft Corp., East Hartford, Conn., has appointed Robert A. Agnew as a member of the company's board of directors. Mr. Agnew is general manager of the Boston Division of UAC.

H. O. Bales, vice president and director of operations, North American Aviation, Inc., Los Angeles, Calif.

Robert King, vice president, Edo Corp., College Point, N. Y. Mr. King is president of Electric Industries Co. Inc.

Harold W. Hayes, vice president and general manager, Boeing Airplane Co., Seattle, Wash.

John F. Day, vice president and general manager, American Airlines, Inc., Dallas, Texas.

Robert A. Agnew, vice president and general manager, Lockheed Aircraft Industries, Inc., Los Angeles, Calif.

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## INDUSTRY OBSERVER

Verde Division of Boeing Inc. was an Army Transportation Research Command competition for a design study and performance design of a ground-effect vehicle and landing vehicle (GEV). General contract for low-cost of small-sized vehicle at Princeton University's Federal Research Center (AW Dec. 7, 1959, p. 137). Other bidders included Convair, Grumman and North American.

General Electric and Avco are studying plasma engines for use with a 100-watt nuclear electric power system under USAF contract.

Thiokol Air Command will close bidding in December for the September 1960 fighter-bomber competition and expects to announce the winner next January. TAC is seeking two engines for subsonic and a two-man test because of complexity of managing electronic equipment. Designers probably will incorporate variable-wing, to increase cruise speed and landing characteristics and reduce banking at supersonic speeds at low level.

Wheeler of an Air Force Technical Staff Division study contract for a permanent interline base and logistics support under Study Requirement 17532 is expected to be chosen before Nov. 1. This follows a later alternative study under SR 285 (AW Apr. 27, 1959, p. 20), on which no specific action has been taken.

USAF has chosen continuing interest in NASA's Saturn space shuttle, and planned operational flight schedule of four per year could easily grow to 20 to 40 per year if both USAF and NASA order it.

Navy is anxious to see foreign sales of the McDonnell F-4H intercepter to help with high development costs, although the company is not making money sales. Latest Navy effort was recent demonstration of the intercepter for the Royal Australian Air Force at George AFB, Calif. USAF's Lockheed F-10B Stargazer also was demonstrated for RAAF.

North American Aviation is formulating a concept for a super Hound Dog, an integrated engine on one Douglas Skybolt air-launched ballistic missile doesn't meet projected USAF schedule. Skybolt managers insist the project is proceeding according to the planned timetable.

Between 20 and 30 companies are expected to submit bids today to NASA's Marshall Space Flight Center for a single automatic checkout system to test all components, subassemblies and completed assemblies of the Saturn vehicle. NASA wants design to use existing hardware. Six-month program will begin with a two-month study program to define specific engine and will include design, fabrication and checkout phase, with funding at the subelement conclusion of each phase. Bidders will include Bendis, TIT, Northrup, RCA and Stouffer-Carlson.

Grange IS-112H helicopter (AW Aug. 31, 1959, p. 126), powered by two 235-hp Lycoming O-540 engines, has received its provisional type certificate from Federal Aviation Agency after seven weeks of test flying.

Navy's Atlantic Underwater Test and Evaluation Center will be critically substantiated for environmental warfare research, advanced logistic support studies and other advanced warfare research. Management of AUETC, with its head office on islands in the Grand Bahama, will be Navyman with technical assistance from industry.

Douglas Aircraft Co. has a USAF contract to study materials and processes for a hypersonic vehicle with a variable wing. Work is being done at Douglas' Sacramento, Calif., facilities and probably is related to Douglas' work on the SIV stage of the NASA Saturn vehicle.

Proposal for subsonic and ground communications schemes for USAF's Dyna-Soar boost glider are being submitted this month to Boeing, which is prime contractor for the glider portion of the system.



AN ACHIEVEMENT IN DEFENSE ELECTRONICS

## WHAT'S BEHIND A BMEWS RADAR?

Years of experience—for as early as 1954, General Electric had conceived and developed radar equipment capable of detecting ballistic missiles at 1,000 miles. This was the forerunner of the AN/FP-50 surveillance radar being provided by General Electric under subcontract to RCA for the Air Force Ballistic Missile Early Warning System (BMEWS).

The AN/FP-50 radar equipment, with a range in excess of 2,000 miles, is a superb example of achievement in defense electronics. It is another milestone in General Electric's continued engineering effort to develop and produce equipment to meet the unprecedented detection problems posed by ICBM's.

11-10

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DEFENSE ELECTRONICS DIVISION  
HEAVY MILITARY ELECTRONICS DEPARTMENT  
SYRACUSE, NEW YORK

## Washington Roundup

### Defense Budget Outlook

Evermore Administration is sticking close to the current defense spending level of about \$40.2 billion in preparing the Fiscal 1962 budget. "New money requests generally run about the same as expenditures. So the entire budget the White House will hand to Congress next before the President leaves office will be practically the same as the final version of the current budget—which includes the additions Congress made."

Military services were told to submit three budget proposals in their initial "budget estimates." One would hold the line at the current spending level, the second would be 5% higher and the third would be 5% lower. The services also have been asked for a priority list of proposed additions to the budget they submit.

House Armed Services Committee staff reports little Pentagon cooperation in drafting legislation authorizing current and future procurements. Fiscal 1961 budget is the first in which the Defense Department will have to ask Congress for procurement authorization as well as appropriations. They grant the armed services committees a review of programs along with appropriations committees.

Defense Department opposed this new approach, which was dictated by Congress last year. It means two rounds of budget hearings in Capitol Hill. And a specific authorization law will reduce Pentagon flexibility in shifting funds from one program to another.

Key questions to be answered in the new process: Should programs be authorized in terms of mission, objectives or dollars? Will the services need authorization to buy substantial quantities of aircraft and missiles for development, test and evaluation programs? How can Congress prevent Defense to make desirable procurement changes after the authorization law is passed without giving the department a blank check?

There is some reason in Congress that the Defense Department is shifting programs from the procurement program to research, development, test and evaluation in hope of avoiding the new requirement for authorization.

### Nuclear Tests Wanted

Atomic Energy Commission is eager to get back to nuclear testing in view of the coupling results from test ban negotiations. Retaining last week from its latest report Atomic Agency meeting in Vienna, AEC Chairman John A. McCone warned of the danger of allowing negotiations to frustrate weapons testing for too long. He agreed with Sen. Hubert H. Humphrey's approach of setting a deadline. Sen. Humphrey suggested June 1961.

McCone sees no reason why the U. S. shouldn't go ahead with a series of small underground explosions, even while negotiations continue. He said such a program would improve the science of seismology and show how detection and identification systems can be improved. McCone pointed out that there is no use of learning whether the Soviets are testing underground right now. AEC is ready to launch an underground test effort as a few weeks' notice.

One of the U. S. debate over testing is the expense of AEC and the money to actually demonstrate breakthrough in small nuclear weapon yields. Substantial gains have been made, making a study of the smaller weapons small enough to fit in a briefcase. Past experience with large weapons makes AEC confident the small weapons will work, but this has never actually been tried.

Texas World Airlines remains in a state of suspense following an indefinite series of board of directors' meetings. The airline continues to operate without a president and planes are strong that no president will be named until the financial picture clears. Fred M. Glus is still the leading candidate. Most likely in the financing picture seems to be Howard Hughes' reluctance to concede the control situation since over TWA is action for their money. Board is expected subject to immediate recall.

British government continues to run against the decision to scrap the Blue Streak ballistic missile as it has the Skunk from the U. S. Many elements of the gun and Polaris and believe it was a mistake to trade an actual ballistic program for what they consider to be still a paper design.

Efforts by the Air Force and Douglas Aircraft, Skybolt's designers, to counter this feeling have included a visit to the Douglas plant by a group of British aviation writers. So far these efforts have accomplished little. Advice received to the project has caused so much concern that the problem is getting the personal attention of AEDC commander Lt. Gen. Bernard A. Schriener.

### NASA's Plans Change

NASA's progress for commercialized flight with orbit to earth will be delayed beyond the original 1964 target so it can become part of the new Project Apollo. Only other official change so far in the 10-year program presented to Congress last January is an acceleration last spring in the Saturn booster program. Big scheduled change in the program is the dropping Project Mercury schedule, with the canceled Redstone flight now out of the picture by 1960.

—Washington Staff



## Major GE Defense Facilities Escape Impact of UFE Strike

Washington—Since major General Electric defense plants escaped the impact of the International Union of Electrical Workers strike, against the new power loss, either because they have no union or have signed contracts with other AFL-CIO unions.

The IUE did affect GE's Portland, Maine plant where the Ordnance Dept produces nuclear reactors for Polaris missiles and fuel control systems for Polaris submarines. The union did strike at GE's Syracuse plant where Heavy Motors, Electronics Dept produces large radars and air defense systems.

At GE's large jet engine and rocket engine plant in Boreville, Ohio the United Auto Workers (UAW) and International Association of Machinists (IAM) locals both voted to accept the company offer of a three-year contract with an annual 10% increase and no other 4% per year in 15 months.

The IAM also accepted the company offer at GE's Light Military Electronics Dept in Dayton and Johnson City, N.Y. Mobile and Space Vehicle Dept in Philadelphia has no union.

The IUE is a member of the AFL-CIO, a laboring union for about 70% of GE's 100,000 hourly workers. Union locals that less than 10% of company's hourly workers are in union should not be affected by the company offer.

Company will try to keep struck plants operating and in a contingency plan to return to work. That is, it would increase cost of company plants during its last major strike in 1946 when it instructed white collared and supervisory personnel not to attempt to come to work except against the company's wishes.

Company's decision stems from reports of political work by IUE locals

which claimed a majority of union members voting wanted to accept the company offer. Decision to strike was made by union's GE Conference Board, which met for 54 hours ending with a single vote negative of the number of members it represents.

At GE's large Syracuse plant which employs about 4,500 factory workers company says that IUE marked for work the first day, 1,000 the second and 1,000 the third day. At Portland, ME about 24% of the factories here are reported to work during first three days. At a small plant in Boreville, Vt. which produces missile air control, 570 out of a total of 700 hourly workers reported the first day. GE said.

The IUE claims company offers are greatly exaggerated. It says that less than 1,000 factory workers reported the first day at IUE's 1,000 the second and 1,000 the third day. N.Y. Here the union's largest GE local, which had voted against a strike, did not actually follow strike authorization of the IUE. Co-leaders Elmer and John J. McInerney, N.Y. Mobile and Space Vehicle Dept in Philadelphia has no union.

The IUE is a member of the AFL-CIO, a laboring union for about 70% of GE's 100,000 hourly workers.

Union also objected strongly to the company's decision to drop the cost of living wage schedule which had been in effect for the past five years.

Some observers believe the strike stemmed primarily from a long-standing feud between IUE President James B. Green and top GE management. Management's higher policies for negotiating contract issues. Company reportedly has sought to establish the principle that its staff officials, whether relevant work, represents contract on best offer and is not subject to market price haggling.

Union and company met with local meetings on the second day of the strike, but the problem seems broke up with no success. Union chief Green announced that "not one single leader at Polaris missile will be forthcoming without a contract." Another union with Island installation was scheduled for later in the week.

Violating discipline and violence are

the policy basis of major plants at Syracuse, Portland, Philadelphia (switchgear plant) and Lima, Ohio, as factory and warehouse workers sought entry, prompted GE to seek court injunctions calling for strictly picketing.

George Moore, president of AFL-CIO was in touch with the president of major unions here last week to discuss a program for support of the IUE strike.

Although some observers see the reported lock-out work movement as an indication of a speech without other elements, that its potential threat to Green's leadership will spark a long and possibly violent strike.

## Soviets Report On Space Flight Studies

Moscow—Studies on the fall to defect any space shuttle as a factor in coming from the second Soviet space vehicle (VSSG No. 16) 70, according to Soviet astronaut Yuriy Gagarin, speaking at a special session of the Soviet Academy of Sciences. As a participant of experiments against harmful radiation, Gagarin indicated that available check sheets now are available. Dealing the future of manned space flight and space vehicles will have an installed control system atmosphere and temperature favorable for human and equipment can be artificially maintained. Pressure in the cabin and barometric pressure 700 and 450 mm of mercury, with partial oxygen pressure of about 160 mm, which can expand to approximately 20-40% of oxygen content. Carbon dioxide content of the capsule should not exceed 1%.

As for the problem of recovery of a manned space vehicle, Gagarin concluded that the Soviet Union long been successful in carrying out a program of self-recovery of aircraft and equipment from space. Soviet and biological experiments on the second vehicle showed temperature increases in hydrophobic and inert gases, as well as a reduction of electrostatic activity in the two dogs, Belka and Strelka.

Astronaut Leonid Sedov said that while he is confident manned space vehicles will make interplanetary voyages, "it should be emphasized, however, that in the coming decade there is no reason to expect space beyond the moon and other planets will be automatic space laboratories controlled by radio systems. It is necessary to fly to Venus and Mars, he pointed out, "to make these flights, we did not have to have to overcome. In particular it will be necessary to ensure self-sufficient operation of such stations."

Although some observers see the reported lock-out work movement as an indication of a speech without other elements, that its potential threat to Green's leadership will spark a long and possibly violent strike.

Violating discipline and violence are

## Army Courier Tests Space Communications

Washington—Army Signal Corps plans an extensive program to fully develop active repeller communication satellite operational techniques during the expected course of life of Courier IB which was launched into orbit last week.

The 500 lb. delayed repeller satellite was launched Oct. 4 by the Air Force from Adair's Launch Range with a Thor-Ablestar vehicle. It was injected into an orbit with a 752 mi. apogee somewhat lower than the desired 1,000 mi. but still within acceptable limits. The 601 mi. per second is well within the desired 100-100 mi. per second. Orbital period is 116.9 min.

Courier IB payload is identical to the 31 lb. dummy package (AW Aug. 20, p. 72) of the Courier IA launch attempt, which failed Aug. 31. It contains about 100 lb. of various equipment including five transmitter/receivers, electronic TME and VHF telephony, transmission information generator, VHF duplex and command control.

Initial operational test was made on the second orbital pass when a voice message from President Eisenhower to Secretary of State Charles Foster was beamed from V. Moscow's. Dual stations in Courier then relayed to the Courier ground station at Silverthorn, Puerto Rico. It was then relayed to the United Nations in New York.

After the President's message was relayed, a videotape by Army Secretary, Wilbur M. Brantley, which was recorded and stored on tape before launch, was broadcast from Courier.

Although Courier is considered a

test vehicle, the Army said it is a forerunner of the more sophisticated Adair satellite which last month was shifted to Army management from the Advanced Research Projects Agency.

Adair will go into a stratosphere, 22,000 m. equipped with a network of three satellites placed equidistant around the earth for world wide coverage. Equipment will be an real time communication using voice signals. Avionics instrumentation will come in advanced auto-ranging and command elements, modes and telephony. (See story, p. 71).

Long-range Adair will weigh about 1,000 lb., and the Army said it can have it operating "in two years plus" at a cost exceeding \$100 million.

Courier IB is the last flight payload of the Courier test program but the Army has not determined whether it will develop the delayed repeller system further or go directly to Adair. Courier transmitters will be permanently activated, in ground command about a year, last flight of the vehicle will be at least several decades.

Double stations of Echo passive reflector and Courier are active to lighten the already intense radioactivity in saturated communications satellite system.

Initial three-month test plan is to exercise both orbiting and ground instrumentation by looking and uploading the satellite to capacity, with telephony and voice signals and, its attempting to receive signals. Voice transmission was cannot be made since Courier has a band width of 50 kb and television requires a width of 3.4 mc.

Spurious carrier two powers and two backup telephony transmission and systems and a voice terminal. It receives Teletype, teletype have a capacity of sending or receiving 15,000 characters per second when in view of ground stations. During nominal 100 min. pass over the two ground stations, capacity is 13.2 million characters.

Courier payload contractors working under Signal Corps assignment are Philip Corp., which built the payload; Radiocon, Inc. designed the P-1 Monomouth and Pacific Radio antennas, and International Telephone and Telegraph Laboratories, contractor for ground receiving, transmitting and control equipment.

Courier launch by the Thor-Ablestar was the 100th time the Douglas Thor has been used as a booster. It weighs over 3,000 tons, is 131 ft. tall, weighs 17,000 lb. and carries 42,000 lb. of solid rocket motors, and 42,000 lb. of solid rocket motors. The stage Thor-Ablestar weighs 79,300 lb. tall with 100 ft. weight

of 105,000 lb. employs standard installation. Thor-Ablestar is first stage and Thor-Ablestar Ablestar is second stage (AW Aug. 30, p. 58).

Thor has 100 sec. Total Ablestar burning time is 300 sec., with the last 15 sec. of powered flight used to inject the payload into orbit. After harvest and first booster separation, a parachute control system caused the second stage and payload to yaw 50 deg. to the right in order to place the orbit exit area perpendicular to the eclipse in full sunlight.

Thor-Ablestar is the last flight payload of the Courier test program but the Army has not determined whether it will develop the delayed repeller system further or go directly to Adair. Courier transmitters will be permanently activated, in ground command about a year, last flight of the vehicle will be at least several decades.

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## Scout Will Launch Satellite Next

Washington—First attempt to put a satellite into orbit using an all-solid propellant launching vehicle will be made in the next experimental firing of National Aeronautics and Space Administration's Scout. First completely successful firing of the four-stage vehicle last week sent a 75-lb payload to an altitude of 1,200 mi.

Desires to try an orbital experiment this week in Scout's development testing program indicates that NASA has considerable confidence in a vehicle that has been planned with many costs and delayed opportunities over the 10, 100,000 and 100,000 lb.

The satellite which may be launched this year probably will carry a meteorological observation payload in an air density measurement and wind speed depending on the orbit altitude.

Scout was fired at 11:25 a.m. EDT on Oct. 4 from NASA's Wallops Station at Wallops Island, Va., at an angle of 5.5 deg from the vertical and in a southwesterly 107 deg.

In parallel, developed by Air Force Special Weapons Center to measure radiation in connection with monitoring of nuclear explosion in space, it entered the earth's atmosphere 90 min later at a point over the South Atlantic 5,800 mi from Wallops and was destroyed.

NASA and preliminary analysis of telemetry data indicated that the flight was completely successful. This was the first successful firing by the U.S. of a fully-controlled and guided four-stage solid rocket and was the largest solid launched by the U.S. Scout is 77 ft long and weighs 30,000 lb.

The 125 ft payload section carried performance-measuring telemetry, and the first and third stages carried some 50-lb of nuclear instrumentation.

Scout was launched two years ago in an attempt to develop a low cost sounding rocket and missile launcher from existing hardware. First launching was at one time planned for the fall of last year. First attempt to test the

previously unknown first and third stages failed last Apr. 15 when a test shock moving the third stage came off, causing a structural failure joint to third-stage ignition.

First attempt to fly the full vehicle last July 8 was aborted by ground command before ignition of the fourth stage because Scout appeared to develop an excessively high rate of roll and to change its flight path. Later study of telemetry data showed that the vehicle did roll but that a sudden shift of the tracking radar was to blame for a false indication of a change in flight path.

Satellite for the first orbital test (Scout) could be a meteorological payload—carrying 140 percented cylinders about the size of beer cans and at least three other types of experimenting devices developed by NASA's Langley, Lewis and Goddard Centers.

Scout's probable orbit is similar to the Echo communications satellite, which could be used to measure atmospheric drag. Scout is expected to be able to put in orbit at 200 lb into a 300 mi orbit, and a 50-lb payload to 5,400 mi altitude, or provide nearly 2 lb of payload in a low orbit.

Scout is managed from Langley Research Center by a group headed by James R. Hall. Lt. Francis E. Holly of AFSCC was project officer for the USAF payload, and NASA's Robert V. Daily directed the launch team.

## Labor Chiefs Invited To Pentagon Meeting

Washington—Top labor leaders were invited to meet at the Pentagon last Friday by Secretary of Defense Donald S. Rumsfeld in a move to ease with continuing production delays in the construction and installation jobs at ICBM bases (AW Oct. 3, p. 25).

In addition to this step, designed to speed completion of Atlas launching sites, the Defense Department wants to further tighten responsibility for the entire base construction program by assigning a third project, the 524 million Atlas base at Plattsburg, N.Y., to the Army Corps of Engineers' new ballistic missile construction office headed by Brig. Gen. A. C. Walling.

## News Digest

First proposal for European production of Hercules II-60C surface-to-air guided missile (AW Aug. 1, p. 72) can be signed by five NATO nations

—Belgium, France, Italy, The Netherlands and West Germany. Raytheon will receive \$5,840,000 for patent and technical knowledge rights.

Two contracts, totaling more than \$22 million, have been awarded by Sikorsky Aircraft for 858 helicopters for use by the U.S. Marine Corps and the Navy.

Rediff Airlines will spend \$9 million to buy seven Douglas DC-7Cs and spare parts from General Aircraft Licensing Division of General Dynamics.

Walter T. Rowsey resigned last week as director of National Aeronautics and Space Administration's Office of Public Information to become director of public information for the Aerospace Corp.

McDonnell Aircraft Corp. was awarded a \$10,000,000 Navy production contract last week to provide for delivery of the second backlog of F-101 all-weather fighter (see p. 52) through 1962. 1413 contracts now total \$160,000,000, accounting for 192 of the planned 460 aircraft production run.

Peluso missile with a new lightweight second stage was fired 1,000 mi down the Atlantic Missile Range last week. Debris was not carried in a test of the engine and firing mechanism.

Scoutair and Western Airlines plans to schedule its 54-250 New York City International Airport hangar to the American World Airways as part of a financial restructuring program. If the move is approved by the Port of New York Authority, Scoutair and Western—both attempting to raise \$6.5 million from the sale of new equipment—would share Douglas T-4 McDonnell with Northeast Airlines.

Newlydeveloped Martin-Belluga air-to-ground missile is being added to USAF's Republic F-105 fighter bomber.

Douglas Aircraft Co. has been awarded a \$71.5 million Navy contract for all-weather A-7D attack aircraft, bringing the total for this model to \$193.5 million.

Ninth Titan ICBM base will be built at Griffin Air B. Base, N.Y., at a cost of \$50 million. It will include two Titan squadrons, handling 15 missiles each, two squadrons, deployed in 1968.

Entire Air Force last week ordered five more Boeing 720 medium range transport aircraft for a total of 15 (AW Aug. 3, p. 47). Total cost is about \$65 million.



Direction controls at work in space — gyroscopic

## STEERING GEAR FOR ASTRONAUTS

Conventional aircraft control surfaces will not guide space ships and capsules. Rudders, ailerons and elevators find no resistance and hence produce no reaction to their movements where there is no atmosphere. Even at altitude only half way up, they are sluggish ineffective.

The successful answer is a dependable steering mechanism for astronauts is a system of jet reaction controls developed and produced by Bell Aerospace Systems Company. First used on Bell's own spacecraft, X-15 several years ago the system has been greatly improved and adopted for the X-15, the Mercury man-in-space program and other space vehicles.

Through strategically located, low and high thrust 1 to

1500 pound reaction engines, Bell's reaction controls not only position and guide the ship by controlling the roll, pitch and yaw, but they also provide for orbit changes and reentry thrust. Some of the jets are throttleable while others are operated in combination to provide the astronaut power and flexible control.

This revolutionary steering gear for space, available under nonexclusive license at high energy hypersonic, is just one of many advanced programs which are currently engaging the diversified talents of Bell Aerospace Company in the fields of rocketry, aerospace and space technology. Engineers and scientists working challenging, long-range counter opportunities can find them at Bell.

**BELL AEROSYSTEMS COMPANY**

**SUCCESSORS IN THE DELTA GROUP OF BELL AIRCRAFT CORPORATION**





## Plumbing the Depths?

Alcoa goes to work immediately on defense projects

Aluminum is common resultant in many, high-purity water or salt water. That's why this water-compatible metal finds such promise in marine applications, as is atomic subs and casements, for example. Alcoa even anticipated the day when water would be the cooling medium for reactors that generate temperatures ranging from 500° and higher. We now have several new aluminum alloys able to handle these higher heats. Ask yourself where you can use them. For more information, write Aluminum Company of America, 2026-K Alcoa Building, Pittsburgh 19, Pa.



## AIR TRANSPORT

### Fuel Injection Failures Grounded II-18

**Quesada reports engine problem halted operations, calls Aeroflot operating facilities substandard.**

Washington—Aeroflot's 80.95 passenger II-18 turboprop transport has been grounded because of engine fuel injection failures which have caused burned out combustion chambers, according to E. R. Quesada, Federal Aviation Agency administrator.

Quesada, who returned last week from Moscow, after a three week tour of the Russian airline's system, and the Soviets refused to admit that the II-18 had been grounded but added that it was highly evident that the aircraft had been withdrawn from service to undergo a fleet overhaul program. He also said Aeroflot's operating facilities are below Western standards and added that the Russians admitted they were embarrassed about showing the group facilities at some ports on the tour because of substandard conditions.

The FAA chief described the II-18 as the "best airplane" the Russians have in their civil transport inventory, and compared it with the Lockheed Electra. Soviets indicated that the II-18 will be back in service soon (AW Aug. 1, p. 47).

Quesada was unimpressed with the An-10 turboprop transport, and in commenting on the Tu-104 turboprop transport which he piloted during one stage of the tour, he noted that the aircraft has stick control forces higher than

the B-17. Because there is apparently no hydraulic control system, he felt two pilots to work on the wheel. He also noted that the Russians "must have been hurt" for its long-range performance on the Tu-104 transport, which has a high thrust-to-weight ratio, but added "our airlines could not use the engine because of its high fuel consumption."

He said that the Russians would not comment on the delay in introducing

the large Tu-134 turboprop or the high-speed Tu-124 medium-range transport into service. Both planes were slated to see scheduled service this year according to earlier Russian announcements. Originally, the Tu-114 was scheduled for service in the summer of 1969 in three configurations: 228 transport seats, 170 standard and 130 seats in the intercontinental version. Late last year, transport seats was postponed to spring 1969, but is still not in sight.

Immediately prior to his departure from Moscow, Quesada said that Aeroflot officials talked in terms of using the Tu-114 if and when a study to New York develops. He said that 500 of funds during the construction of the new An-34 turboprop transport (AW June 6, p. 17) but was rather unenthusiastic about the Tu-124 transport (AW Aug. 22, p. 41), which had just started to appear in "long haul" for its first mission.

He said here that he was under the impression that the Russians have launched a supersonic transport program, but he felt that the plane was being designed for speeds under Mach 2 and that it would be ready for flight within five years.

The ICAO delegation visited areas for stations and facilities at Moscow, Leningrad, Kiev, Tashkent and Novosibirsk. Other members of the group were Stuart G. Tipton, president of the Air Transport Vow, Wichita, Kan.; and vice president, Pan American World Airways, Raymond Dunn, vice president, Trans World Airlines, New York; Henry B. Brad Corp., Richmond, Va.; J. D. McKel, Arthur Corbett, all of the FAA, and State Department member Alexander de Belder.

#### Quesada's Observations

In Moscow, Quesada gave this summary of his observations during his visit:

• **Imports.** Landing fields particularly necessary are not in good in the design program expected. They were rough in some cases and too short for the large transport aircraft used by Aeroflot. For example, the wheels of the Tu-104B transport in which the delegation left Tashkent were from ground level with a 50% of the nose gear height instead of about one-half which would be standard in the U.S. "There is no margin for error, before it's late," he said.

• **Pilots.** "That's an open goal. I would judge that Aeroflot gets very stringent in pilot selection. I feel that follows in the Tu-104 have had a lot of trans-

### Birds May Have Caused Electra Crash

Crash of an Eastern Air Lines Lockheed Electra last week into Boston Harbor with the loss of 61 lives set off somewhat exaggerated demands that the turboprop transport be grounded.

Federal Aviation Agency Administrator E. R. Quesada said he would not ground the Electra because there was no evidence of structural failure involved in the accident, which was the fifth in less than two years for the plane. The FAA chief said all evidence indicated the Boston crash was caused by a collision with hundreds of seagulls which may have been caught in the engine intake, producing a "flameout" condition.

The Electra aircraft was taking off late Tuesday afternoon from Boston's Logan International Airport on a flight to Philadelphia. Charlotte, Greenville and Atlanta. Wind and weather were normal, with a ceiling of 15 mi. The plane crashed on a shoal of 200-100 ft, several feet and traveled about 2,000 ft from the end of Boston's harbor pier before plunging into a channel in the harbor.

The Electra was carrying 60 passengers and a crew of five. Of the crew, only the two stewards survived. One reportedly entered only seven seconds and the other a broken piece.

Rep. Victor Riffe, (D-R.I.) held a news conference with Quesada by demanding that the Electra be grounded and that Quesada resign his job. Quesada replied that he was unaware of any "inland background" pointed to the accident.

Meanwhile, Lockheed Aircraft Corp. a line at Burbank is full with orders to overhaul Electra having been discontinued as they go through the line. These modifications are designed to correct the structural flaw which caused two of the Electra crashes (AW Aug. 6, p. 16). Part of the planes with flaw built in is expected to fly this month, and the first other Electra in error is for the modeler due to scheduled to arrive in mid-November.





# Initial Capacity Restriction Drive Fails

By L. L. Doby

Capitoline-Europe flight by the U.S. to impose capacity restrictions on foreign flag carriers in a series of restricting a growing current of competition on international routes serving U.S. markets apparently has failed.

At the same time, mounting pressure from other nations for more restraint on traffic capacity, offered by U.S. carriers in facing the U.S. a steady traffic surplus, which means a steady change in U.S. international air motion policy and which in turn could reshape overall competitive structure.

On this issue, the U.S. found it necessary to have an initial policy of an open market for all carriers, in case of modified control on U.S. flag airlines' competition (AWF Aug 1 p. 17).

The question is which the U.S. now finds itself entangled stress primarily from the almost impossible task of setting commercial competitive conditions at a high government level. And as long as U.S. carriers must operate at a profit as business ventures in competition with an increasing number of foreign flag carriers while at the same time in

long upon the government to determine the results of that competition, the question will remain.

The problem, if there is any, and one which would make the abrupt change in U.S. civil aviation policy, may be in some government circles of civil aviation which will draw strong arguments from individuals in the industry of "foreign nationalism" or single agencies or U.S. international trade agencies. Industry officials feel that color solution is a possibility, but it is considered unlikely that a more liberal policy will be made unless the industry suffers economic setbacks as a result of this competitive situation.

Here is how the U.S. finds it in a foreign nation on the international air traffic field.

- A virtual interdiction of traffic to which the U.S. has applications for flight rights in the U.S. (AWF Aug 15 p. 41). Under the principle of reciprocity, the U.S. must grant these rights in return for rights the U.S. already holds in some countries. U.S. airlines are now operating over 24 countries which have a bilateral agreement with the U.S. but do not now return the service.

- U.S. may be forced to grant new routes to carriers denied among this country. The British Overseas Airways Corp. will request traffic rights in Los Angeles plus a new America/Los Angeles/Los Angeles route. The British was denied this request. Zurich/Transatlantic is a long-range traffic to Los Angeles, a long-range traffic to Los Angeles.

- Capacity restrictions will be imposed on U.S. Fifth Freedom traffic, as traffic carried by U.S. carriers than a traffic carried by other carriers, is very important to the U.S. For example, 55% of the traffic handled during the first six months of 1958 by Pan American out of Boston Area was Fifth Freedom traffic and it was 57% for Chicago in the same period. Demand for capacity restrictions have caused a number of bilateral negotiations denied (AWF Aug 13 p. 18). Chances are strong that the U.S. will be forced to make a similar demand, since there is no U.S. carrier from countries involved unless capacity limitations are put into effect on its and probably will be raised out. Because of the large number of airlines now serving global markets, most nations are no longer reliant upon U.S. carriers to maintain an aerial line of common carriers beyond their territory as was the case immediately following

World War II when initial bilateral agreements were negotiated.

- U.S. will be forced to change its national diplomacy if it is to realize an access in negotiating Fifth Freedom traffic rights on foreign flag carriers. Reciprocity in negotiations with the Scandinavians here last month (AWF Oct 1 p. 25) involved from individuals, moved by the U.S. in a new case on how far it could go in placing a ceiling on traffic capacity—beyond the U.S. a victim of the type of open market and open competition it is to struggle through several years ago. With the influx of more such on international routes, U.S. carriers which derive a large part of their output in competing with one another—no longer such a strong supporter of freedom of the skies for all.

The State Department is now set to return to the results of the traffic law and to continue to raise levels of restriction on Fifth Freedom traffic. In addition to the Scandinavians countries included Switzerland, the Netherlands, Belgium and countries which have a broad and better rule on Fifth Freedom traffic—no such rule still in effect, no restriction.

The Scandinavians, for all pasted papers, have recently initiated the U.S. drive to introduce new firm contracts. The United Kingdom Government, on the other hand, is refusing to submit to new U.S. interpretations of the bilateral pact and by breaking into U.S. requests for Fifth Freedom traffic statistics.

So far, the U.S. has been able to maintain its position in refusing to submit to new U.S. interpretations of the bilateral pact and by breaking into U.S. requests for Fifth Freedom traffic statistics.

The U.S. now has been forced to submit to new U.S. interpretations of the bilateral pact and by breaking into U.S. requests for Fifth Freedom traffic statistics.

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no run to accept its own interpretation of the bilateral principle—beyond on which the majority of the bilateral agreements is based. The Scandinavians agree to the bilateral principle since 1947 after SAS had won a pole position between the West Coast and Scandinavia and have held to their own interpretation of the principle since then.

Key to the dispute during negotiations here was U.S. demands to restrict traffic moving beyond Scandinavia from the U.S. to third countries. The Scandinavians argued that such traffic was not Fifth Freedom traffic; that the U.S. had no control over it if it came it was traffic moving under the terms of bilateral agreements. The Scandinavians had argued with the other third countries.

The U.S. accused the term "Sixth Freedom traffic" which it applied to beyond traffic and which, it charged, was the same as Fifth Freedom traffic, and therefore subject to control. The Scandinavians were a thing to admit the new term had originated there, but there had been no mention of any restriction of Sixth to Fifth Freedom traffic. The Scandinavians argued that such a term was not in the bilateral agreement nor formulated at the time when the first

freedoms were originally evolved. Scandinavians' definition has pointed to the main principle of the bilateral agreements, which indirectly apply to Fifth Freedom traffic in an organized traffic "designed for and coming from third countries at a point or points on the route specified in the annex to the agreement."

Scandinavians argue that the specific refers to traffic destined for and coming from third countries which are intermediate points on the main route specified in the agreement and then not subject to traffic moving beyond the Scandinavians' countries.

Then, held that, if Sixth Freedom traffic is the same as Fifth Freedom traffic, then the U.S. has the right to restrict traffic moving from Scandinavia beyond terminal points in the U.S. named in the agreement.

The U.S. made several unsuccessful bids to compromise. For example, it proposed that traffic moving from Scandinavia to Sweden be or longer could be considered regular traffic, even though it moved beyond Scandinavia to third countries at a later date. This proposal was not accepted. However, the Scandinavians agreed to a new agreement with U.S. interpretation of Sixth Freedom traffic.

## Patterson Urges CAB to Approve Sweeping Capital Merger Changes

By Robert H. Cook

Washington—Sweeping changes in Capital Airlines management, voting rights, the merger raises some labor problems, and there are likely to be a mass sale before the Oct. 14 meeting of stockholders of both airlines. If the Board approves the merger, the United States labor problems, United States labor problems, United States labor problems for some time.

Recently the problem is that United's labor groups, such as the Air Line Pilots Assn., Flight Engineers Assn., and International Brotherhood of Teamsters, are in a better bargaining position by virtue of their greater number of members than the Capital unions. Merger agreements will be negotiated by the union members and submitted to the surviving company, as in the Delta-C&S merger.

United's union are divided among the Board elected members of a discussion held July 31 between CAB and officials of United, Capital and Valair-Astravia prior to the airline's joint announcement of merger plans on the same day.

Meanwhile, CAB is upholding its promise to regulate the merger process by application of the anti-trust laws under a "no flyright" clause in ALPA's contract which caps U.S. Capital has an estimated 700 pilots to merge into a combined schedule. U.S. Capital, members at Capital already have been scheduled to fly the 10,000 miles of 15 Voyagers to Valair-Astravia by United, said Patterson's

in a general agreement on proposed terms, the merger raises some labor problems, and there are likely to be a mass sale before the Oct. 14 meeting of stockholders of both airlines. If the Board approves the merger, the United States labor problems, United States labor problems, United States labor problems for some time.

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announced intentions to dispose of most of the remaining Capital fleet. All go to new competitive opportunities within the new company.

United claims about 700 flight engineers who are ALPA members and are pilot qualified, compared with an estimated 70 Capital flight engineers who are ALPA members. In this case, Capital flight engineers would be faced with the choice of remaining on a combined U.S. schedule, or the danger of being laid off at a later date because of a low security position, or combining with United's flight engineers.

National Mediation Board has spent weeks hearing arguments from ALFA that a "dispute and order" determination for flight crew is needed at United. NMB approval of the request could have the second effect of placing all United flight engineers on an ALFA contract.

Problem also could arise from efforts to combine security for the airline's mechanics, under International Assn. of Mechanics wage provisions, a general contract between the two airlines.

Patterson said that the CAB should make Capital completely will be absorbed through general attention and operation of the United network, but he has made it clear that Capital's level of finance and management will be the first target for demand as one of the merger agreement provisions.

Criticizing Capital's management, Patterson said he had not discussed with which members were responsible for the airline's financial losses. He said, "I do not see that the airline. And I hope the Board does not waste something in how it works. We are going to be forced to give these fellows a premium of 5 cents in 1 month, or 3 years per year."

United's president told CAB that he strongly favors Board approval of Capital's requests to abandon 10 steps in its union as a gesture which could result in a merger of Capital employees.

"But for goodness sake," he said, "please don't come around later with a decision that Allegiance, or any other airline, who gets the step down, have to take them. We are going to tell the airline people: They should go with the people who got the benefits."

## Boring 727 Decision

Renton, Wash.—Boeing Airplane Co. decision in record with 727 transport project now depends on whether Eastern Air Lines and United Air Lines will purchase a financing package to back the purchase of 40 aircraft.

The two airlines have presented letters of intent with open escape clauses to the manufacturer providing for a 60 day option period in which to seek and accept a financing package. Boeing has the time period of time to move ahead with final design work, and decide whether to begin production on the strength of an order order for 50 aircraft.

The Boeing 727 will be powered by three turbofan Pratt & Whitney JT8D-1 turbofan engine and will cruise at approximately 600 mph with a range of 1,800 mi. It will accommodate between 70 and 110 passengers and cost \$4.5 million.

Bankers and insurance companies are now studying the project to determine whether they will be willing to underwrite new planes at this time. The Boeing of the 727 has been built twice at 1965.

## Aeroflot Jet Anniversary

Moscow—On the fourth anniversary of Aeroflot's first scheduled jet passenger service, Russia noted that it is still operating more jet transports than any other nation. The Soviet area said that jets and turboprops are in service serving "over 100" domestic routes.

Aeroflot began its jet service in 1954, with a flight from Moscow to Leningrad. The USSR's largest volume of jet traffic presently moves over the Siberia and Moscow-Leningrad route. In 1958, the USSR's 10th route to Leningrad was opened.

# Airport Area Land Use Problem Studied

Washington—Dealing with mounting problems of land use effects on and estate values in airport areas has become a top priority project with the Federal Aviation Agency, which is now studying a strong nationwide airport area residential construction through close liaison with the Federal Housing Administration and other government agencies.

Urban population growth in former rural areas around major jet terminals in the past two years has spurred FAA and the Urban Renewal Administration to join forces to combat the latest problem—FAA's problem of public complaints over harbored noise. FAA's managing manager said, which could be incurred by a drop in real estate values because of noise and URA's responsibility to prevent urban flight that could result from an significant decrease of values.

Typical of the growing community concern over this problem was the observations of the New York State Governor, Governor Rockefeller, by Commissioner Keith S. McHugh last week before a meeting of the State Assembly Development and Operations Committee.

"Only a few of our communities have passed their airports and even those gave very little thought to the noise problem," he said. "In the past the primary purpose was to prevent the creation of structures which might interfere with the glide or takeoff stages of aircraft, but experience has proven that it is just as important to prevent the growth of communities in opposition to airports, as it is to prevent the creation of structures."

Through its control of federal funds for airport construction, plus rules for harbor islands and landings, FAA has been attempting to allocate much of the public protest against jet noise, but local authorities to ward off the problem in the critical fields of new shopping and housing in areas adjacent to airport projects.

**FAA-FHA Coordination**

In practice, FAA has succeeded in preventing a great deal of residential building either in too close proximity to airports or heavily sprayed programs, through the cooperation of the FHA. The housing agency has accepted many mortgage guarantee loans for houses and apartment projects on the basis of advice from the aviation agency.

However, neither FAA nor FHA have been able to exert any concerted power by influencing local housing communities to follow land use patterns in

airport areas to permit the continued operation of aircraft without the problems of public objection to harbored noise as a nuisance or threat to property values.

Selection of a majority of the existing problems and those of the future, both FAA and FHA officials feel, could result from a combination of a special research study project now being conducted for the Detroit Metropolitan Wayne County Airport under a grant from URA, and from FAA's suggested noise abatement program for airports now being studied by FHA and other agencies.

While FHA has been receiving loan guarantee applications on an individual basis after consultation with FAA, adoption of the aviation agency's airport noise abatement program would provide the housing agency with an first checklist to judge future applications within a framework of actual topographic limitations for construction surrounding airport areas.

At the same time, both the Federal Aviation Agency and the Urban Renewal Administration hope that a final report on the Detroit survey will serve as a nationwide model of land use planning and zoning in airport areas.

The first specific study of this type undertaken by URA, the Detroit survey will take nearly two years to complete at a cost of \$45,000 of which \$10,000 has been provided by the government. Results of the study are being turned to Wayne County, the Detroit Metropolitan Area Regional Planning Commission which is conducting the study. Remond Township where the airport is located and the Remond Township School Board.

Using the Detroit Metropolitan Wayne County Airport as a "laboratory," located in a sparsely populated area 16 mi. from the center of the city, the planning commission has set the following objectives:

- Determine the actual and estimated noise levels created by jet aircraft operations.
- Outline the noise surrounding the airport which is actually affected by such operations.
- Estimate existing land uses in the study area.
- Determine the actual potential level of aircraft noise exposure based on statistics which the airport can expect to attract.
- Develop a land use plan of the area which must include the limitation of new housing procedures according to noise levels and existing if the combination of land uses and airport aircraft operations.

Initial start of the survey will require a noise study by an acoustical engineer, but eventually will include several of the points in order for FAA's suggested noise abatement program, such as a recommendation that the Department of Health Education and Welfare take action to discourage the building of schools and hospitals in areas the airport noise boundaries outlined by FAA. A major part of the Detroit study will consider the effect of airport noise level on a Remond Township school located one mile to the west of the airport.

FAA's report on aircraft noise planning, based upon experience with Boeing 707 and DC-8 operations and numerous publications the association of an residential type dwelling as public standards buildings close to a busy airport, will include a list of 21 criteria and 15 mi. from the airport end. Restricted zoning control lines indicated by the agency are based on the noise levels of noise level readings which noise would decrease below 50 db.

In further, adoption of FAA's plan for an airport with a single 10,000 ft. island runway would create a restricted zoning area increasing at least one mile wide and five miles long. Airports with a greater complex of runways would cover a greater area for restricted zoning.

## Farmed Land Uses

FAA points out that its suggested restrictions apply only to additional developments in such public agencies as schools and hospitals, so that a large portion of the land now be used for agriculture, recreational and industrial purposes. Both FAA and FHA favor types of light industry for the area, which could serve as a buffer between the surrounding residential community and airport noise.

New York's Remond Airport has been cited by FAA as an example of its cooperation with FAA drivers to build residential building too close to airports. A few months ago FHA officials and an independent consultant a 500 house residential project greater of a mile from a runway to the north-east was denied and a second deal was cited by FHA for a project which would have occurred about 50 miles to the north of the airport, but a runway to the south. An application for a project of approximately 2000 houses located 25 mi. to the north of the airport runway, was approved on grounds that planned air conditioning to reduce noise levels of the site from harbor islands because industries would be closed much of the time.



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This is the type of flexibility that will ensure the many and varied problems encountered in air cargo operations, because of the growing demands of shippers, are being solved to provide a combination of short, medium and long range air cargo services for the carrier of length at attractive and competitive tariffs. In the morning, the Canadian Forty Four offers excellent economy and earning ability over the complete range of route structures that must be provided in the collection and distribution of air cargo.

Practical applications of this are found in the short route cargo services that are necessary in the supply and distribution of goods to or from the terminal points of a continental and trans-Atlantic service. This is evident between the major cities of the Eastern United States and between the principal points of Europe. These inter-city runs are essential components in the long haul trucking lines, and with the Forty Four can be handled without a change of aircraft.

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## Political Roadblocks Hamper Jet Airport

New York-Port of New York Authority has been encountering political roadblocks to its proposal to build a \$210 million jet airport near Morris County, N. J. (AW Dec. 21, p. 16).

The Port Authority's operation has been made exceedingly difficult by a committee of the U. S. Congress and by a New Jersey senatorial committee. In October last month before the state, body, executive director Angus Tobin of the Port Authority, requested the need for another major airport.

But Tobin and the Port Authority's job is only to report the results of its findings to the legislators and governors of the two states, not to make recommendations or pass legislation. The report will be made in a "definitive" study not scheduled for release until March 1961.

Another recent development concerning the airport project was the offer of 1,900 Morris County acres to the Federal government as a wildlife preserve. The Port Authority will not comment on how this might affect future airport plans.

In a preliminary study the Institute argues estimated that the need for a fourth airport in the region would be met as early as 1965 when, according to the Port Authority, the capacities of La Guardia, New York International and Newark airports would be reached quite to handle the increased traffic. Among 15 cities evaluated, only the Great Swamp location would meet its needs, says the Port Authority.

However, members of the area could a storm of protest against the possible location of an airport there and have been urging a continuing campaign against it. The Port Authority requests the approval of the New Jersey and New York legislatures to build its jurisdiction to the site to question, as well as authorization of particular major projects. Both houses of the New Jersey legislature earlier this year unanimously rejected the airport site, but now before approval is Morris County, airport.

## EAL Offers Enlarged Mexico City Service

New York-Eastern Air Lines will offer round-trip service between New Orleans and Mexico City beginning Oct. 16 in another move to pack demand of its U. S. Mexico routes. New York-Mexico City, weekly jet service, is expected to begin this year following a recent agreement between Eastern and American de Mexico (AW Oct. 1, p. 36).

Like the New York-Mexico route, Eastern's route from New Orleans had been selected to first class service. Lifting of the restriction has both routes provides the first and opportunity for large scale development.

Eastern plans to offer round-trip service from New Orleans to meet demand near Douglas DC-7B equipment. It expects to attract travelers from other U. S. ports on the airline's routes to Mexico via the New Orleans gateway.

The timetable would fly fast over the route in 5:11:30 compared with 5:13:20 for class. Southbound flight time is 5 to 25 min.

## Firm Seeks World Market for 749As

New York—Comptech that has bought Eastern Air Lines' fleet of 15 well-built Lockheed 749A Constellations (AW Sept. 18, p. 34) expects to find a worldwide market for the potent plane.

The 749 Constellation has not been considered an attractive item in the generally depressed used aircraft market. However, Kenneth Marshall, president of the Transit Equipment Co. of New York purchases Eastern's 749As, told Associated Press that these planes should be marketable on a wide base.

Like the New York-Mexico route, Eastern's route from New Orleans had been selected to first class service. Lifting of the restriction has both routes provides the first and opportunity for large scale development.

According to Marshall, the planes are equipped with built-in 1049-hp landing gear, 4,500-gal fuel tank capacity, better air conditioning and other improved accessories. Thus, experienced Marshall said, should make them attractive to some foreign airlines. The planes also have been built to be fitted with U. S. supplemental carriers engaged in Military Air Transport Service work. The 749As can be fitted with 85 or 62 seats.

Transit Equipment's past experience has included purchase of different models and equipment for dismantling and stripping or resale. The company now aims to find aircraft in the 1940s, Marshall said, but had not participated recently with jet use. Recent loss has been noted primarily in the sale of several Douglas DC-6s and subsequent resale.

The planes have been stored at Lancaster, Ky. They will be moved to Eastern's Miami facility.

Neither Eastern nor Marshall would advise the sale price of the used Constellations.

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### Varig Operates Two Boeing 707-441s

Varig Airlines of Brazil is operating two Boeing 707-441 international jetliners on routes connecting New York, Brazil, Rio de Janeiro, Sao Paulo, Porto Alegre, Montevideo and Buenos Aires. Total of three round trips on these routes weekly.

### Flying Tiger Lists Fiscal 1960 Net Loss

Flying Tiger Line suffered a net loss from operations of \$774,728 during the fiscal year ending June 30, 1960, the airline has reported. Interest and debt expense increased the loss to \$1,560,477, with a tax credit and equipment sales bringing the final net loss to \$998,668.

During the previous fiscal year, Flying Tiger earned a net of \$6,191,966 from operations and capital sales. Air freight revenues for the same period were up from \$13,315,695 to \$14,656,164, but salaries and commercial charges increased from \$21,251,218 to \$21,150,708.

The airline attributed its latest results to "extreme conditions in the airline transport field," but said the situation is now being corrected.

### Pan American Seeks Stock Deadline Delay

Washington—Pan American World Airways asked the Civil Aeronautics Board last week for a six-month extension of the deadline for terminating its stock agreements with National Airlines, citing presently depressed stock market conditions in support of its request.

In July 14 order, the Board directed Pan American and National to return the 400,000 shares of stock mutually exchanged and to cancel an option held by Pan American to purchase up

to 250,000 shares of National stock. The Board gave the airlines 60 days to implement its order.

Pan American told the CAB last week that certain alternatives for disposal of the stock do not now protect the two carriers in light of the recent slump of prices on the New York Stock Exchange.

Pan American said: "If the parties had to act now, they would have no alternatives but to return the shares which would have no adverse effect on the equity of both parties, as it would deprive them of additional equity which resulted from the success of the shares." Pan American then asked the Board to approve a six-month extension, instead of a 90-day extension recommended by CAB's Bureau Counsel.

### French Lines Extend African Jet Service

Paris—French carriers have extended jet service from Paris throughout West and South Africa areas.

Air France is using Boeing 707s while two private carriers, Union Aérienne Trans de Transport (UAT) and Transports Aériens Intercontinentaux (TAI), are using Douglas DC-8s. UAT, which holds the old French rights to South Africa, now offers DC-8 service between Paris and Johannesburg, South Africa.

Flight times between these two points had been reduced to 12 hr instead of 24 hr. Fort-Louisville, one of the busiest cities now is covered in just over 7 hr instead of 14.

In addition, Air France and UAT, in order to meet the jet transport needs of western African lines have jointly set up a new company, Air Afrique. Later next year will work with the newly independent French African nations in developing local air service.

### Board Goes to Court In ATA Probe Fight

Washington—Civil Aeronautics Board last week asked the U. S. District Court for help in its battle with Air Transport Union over disintegration of the Board's role in its investigation of ATA.

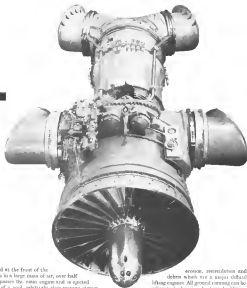
CAB asked the court to force ATA to submit certain documents the Board has ordered produced, charging ATA has consistently refused to make them available. CAB told the court that after an investigation with its agencies and began, ATA's adopted tactics of obfuscation and delay "is a rebelling."

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CAB has asked the court to compel Tipton to appear before CAB Chief Examiner F. W. Brown and produce the records required by the subpoena or compel the ATA to make the records and documents available for inspection at its offices in Washington.

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**A single power source for VTOL and STOL aircraft.** The new Bristol Siddeley BS-53 high turbofan represents a major engineering breakthrough in the field of VTOL and STOL aircraft propulsion because it provides the versatile design with a single power source for all conditions of flight.

**VTOL, STOL and normal take-off capability.** The most revolutionary feature of this unique engine is that the thrust can be evenly applied around the centre of gravity through four main air ducts which are directed downwards for lift, backwards for thrust, forwards for braking in flight, or in any intermediate direction. This makes possible, for the first time, the design of single or multi-engine aircraft in which the total installed thrust is available for vertical or short take-off with a normal payload or for conventional take-off with a large overload.

**High load factor, high thrust, low fuel consumption.** The BS 53 is a high thrust engine and the basic design concept which makes its versatile performance possible is a high lift-fuel ratio.

A fan, located at the front of the engine, draws in a large mass of air, over half of which bypasses the main engine and is ejected in the form of a cool relatively slow-moving stream through the two forward nozzles. The remainder passes through the gas generator and supplies thrust to the two rear nozzles. This arrangement greatly improves the engine efficiency and gives the BS 53 a higher thrust/weight ratio, a lower specific fuel consumption and a lower noise level than any turbojet of comparable power in existence today.

**Conventional installation, operational simplicity.** The BS 53 is installed normally with forward facing nozzles and the simplicity of its components are based on well-known principles already proved in service. These factors make for operational simplicity, easier maintenance, greater reliability.

**Reduced problems of ground clearance and manoeuvring.** Because the velocity and temperature of its jet effluents are low, the BS 53 minimises the problems of ground

erosion, over-rotation and ingestion of debris which are a major difficulty with fixed lifting engines. All ground manoeuvring can be done with the reduced overhauling requirements like a conventional turbojet. Taxiing also is perfectly normal and at take-off a short forward roll before the nozzles are deflected backwards ensures that all debris is left behind. As a result, the BS 53 does not require prepared sites and is independent of all fixed ground installations.

**Selected for the world's first VTOL fighter.** The Bristol Siddeley BS-53 has received the support of the Mutual Weapons Development Programme for NATO and has already been selected for the world's first fixed-wing aircraft designed for operational service with VTOL capability—the Hawker P.1127. Although this remarkable engine was primarily designed for this type of aircraft it is equally suitable for any single or multi-engine, subsonic or supersonic aircraft which requires VTOL or STOL capability.

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## AIRLINE OBSERVER

► De Havilland is developing a new version of its Trident tri-jet short haul airliner designed specifically for the U.S. and Canadian markets. Trident Series 2 design grows 148,000 lb and features an 8-ft extension to the fuselage allowing up to 120 passengers in convenient seating, a reduction in wing spanload from 35 to 16 deg, increased fuel capacity to permit Chicago-San Francisco nonstop flights on U.S. routes and Toronto-Gatwick nonstop in Canada. Engines would be either Rolls-Royce Conway RB 141 bypass jets or Pratt & Whitney JT3D turbofans. De Havilland now has its latest Trident 3 more than half finished at its Hatfield plant with three other aircraft under construction with production type tooling.

► Armstrong Whitworth is planning a VTOL version of its Agave airlifter for military transport use (AW Sept. 12, p. 35). Two batteries of Rolls-Royce jet lift engines on pods would replace the Dart turboprops in the outboard nacelles. Two turboprops would replace the Darts in the inboard nacelles. Lift engines pods would probably replace 20 Rolls RB 162s in each pod.

► British government policy decisions have been made to continue development of the Future Rotavision VTOL transport, now transferred to the integrated Westland helicopter combine, and to abandon further development of the turboprop-powered Westland Westminster based on the Sikorsky single rotor design. Neither of the Rotavision's customers—British European Airways and New York Airways—was ever enthusiastic about the Rotavision's transport prospects. BEA is worried about the noise problem in metropolitan London while New York Airways is disappointed at the negligible outboard displacement progress made during the past three years at the Rotavision factory. Considerable aerodynamic and structural changes are in progress for the commercial version of the Rotavision.

► Deliveries of the Viking Viscount turboprop transport to Trans-Canada Air Lines are well being delivered by Rolls-Royce TFE engine deliveries. Rolls says it has fixed a fix for the turbine disk failure that occurred in the Twin (AW July 4, p. 45) but is not yet delivering production engines incorporating it for the Viscount.

► Watch for a Federal Aviation Agency regulation requiring third pilots to undergo the same training as certificated pilots in aircraft which permit third crew members to operate aircraft. No federal regulation governing these requirements for third pilots now exists. The ruling is not expected to change company rules of some carriers—American for instance—which prohibit third pilots from landing controls under any circumstances.

► United Air Lines will offer for sale the 41 Viscounts it will acquire if the United/Capital merger materializes. Although it will keep the fleet in scheduled service as long as it is part of the merged carrier's aircraft inventory.

► Restricted airspace within the continental U.S. and possessions has been revised to comply with Federal Aviation Agency's policy of handling all applications for controlled airspace in one-step processing. Last month's law of 124,000 sq mi represents a 15% decrease from the 145,078 sq mi of airspace contained in June, 1959 (AW Aug. 8, p. 40).

► British Overseas Airways Corp. will withdraw its de Havilland Comet 4 turboprop transport from the North Atlantic route Oct. 31. BOAC's transatlantic jet service will be conducted exclusively by Boeing 747 Intercontinental jets powered by Rolls-Royce Conway bypass engines. Comets will be diverted to Far East and South American routes.

► India and U.S. officials will last week on amendments to the bilateral air transport pact between the two countries. Chief issue at stake is restriction on traffic capacity.

► International Air Transport Association is meeting late tomorrow in London to discuss adequate fuel saving space for its traffic conference and now feels that it will be forced to issue concrete limits for the annual savings of the conference.

## SHORTLINES

► Air Transport Association reports U.S. air inflated airlines' flight traffic rose 9.7% during the first seven months of 1960 over the same period last year. Domestic and international air traffic rose 10.1% and 9.7% respectively. The association says 373,474,000 for the seven months ending July 31, against 321,788,000 for the 1959 period.

► All-Allegany Airlines will issue a month's, 551-page guide containing the carrier's routes and schedules as a quick reference to passengers.

► Capital Airlines has asked the Civil Aeronautics Board for permission to begin operating "air bus" service between Pittsburgh and Miami at a one-way fare of \$45, effective Oct. 13. The airline and the new fare represent a 26% reduction from regular day coach fares.

► Delta Air Lines' (helped) to increase service on each route as its system has been suspended until Dec. 15 pending acceptance by the Civil Aeronautics Board. The increases would cover several routes on the western part of Delta's system.

► Pacific Northern and Alaska Airlines have been cleared local service routes between Portland and Seattle/Tacoma, or flights from Portland to Alaska, by the Civil Aeronautics Board. It is between the CAB and local service between the two northwest points was adequate as provided by West Coast Airlines, Pacific Airlines and Northwest Airlines.

► Pan American World Service has requested Civil Aeronautics Board permission to suspend until May 30, 1961, service on its polar route from Los Angeles/San Francisco to Paris. Pan American will continue to operate the route from the West Coast to London with connecting service to Paris.

► Reliable Airlines and Pan American World Airways proposed decreases in routes or routes commensurate with new New York and points in Puerto Rico have been accepted by the Civil Aeronautics Board for acceptance. Pan American's traffic was filed for "the future purposes," and the airline told the Board it is prepared to withdraw if the Board determines Reliable's status. Pan American, Trans Caribbean Airlines and Allied Air Freight International Corp. filed complaints concerning the plan would be unacceptable. The proceeding is in the New York/San Juan Cargo Rates Investigation.



Shown above is the modified version of the AN/GQP-9 unit.

## AIR FORCE SELECTS BENDIX TAPE-CONTROLLED TEST UNIT FOR SKYBOLT MISSILE CHECKOUT

The Air Force Type AN/GQP-9 Checkout Sequence Programming Set—a universal, automatic programming-computer—is now in quantity production at Bendix. It is designed for automatic GO/NO-GO checkout of the GAM-87A Skybolt air-launched hypersonic ballistic missile manufactured by Douglas Aircraft Company. In addition, the device—capable of making as many as 100,000 test evaluations—is adaptable to a wide range of other programmed, sequential test-

ing and monitoring operations.

Some functions of the AN/GQP-9 are:

• Selection of signal control channels for application to systems under test.

• Regulation of program execution in accord with measurement and evaluation results, or holding program conditions as directed by tape intelligence and selected operating mode.

• Operation of visual and printed read-out devices to indicate test data in accord with selected mode of operation.

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**90-MINUTE CONVAIR B-58 CHECKOUT** BSA another example of proved Bendix support capabilities in this flight-like checkout-on-wheels. Precision flight control system checkout procedure required the time of two men for days to make and static tests. This automatic Bendix equipment makes 700 static and dynamic tests in 1 1/2 hours. The B-58 flight control system is controlled by Kellogg-Patterson Division of The Bendix Corporation.

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**SPACE TECHNOLOGY****Oxygen Test Studied as Astronaut Check**

By Cecil Brexendorf

Zero-to-hundredth sample, aerospace method of determining the maximum capabilities of space vehicle crew members in event of the disaster that may occur is now being held at the Second International Congress of the International Council of the Astronautical Sciences.

Turning the electronic tests employed in the selection of National Aeronautics and Space Administration Project Mercury candidates complicated "test seating" and "exposure." West German biotechnologist Dr. Rüdiger Reiff believes that an individual's resistance to shock of not all stresses can be determined by a single experiment—rather, testing has to be an individualized oxygen supply.

Inefficient oxygen, Dr. Reiff tells, seems to establish an considerable mass and the adaptability of the body and therefore, its capacity to resist.

Dr. Reiff—pointing out that a person's resistance factor can change day to day depending upon his immediate exposures and physical condition—considers that a major advantage of his system is that it would permit an accurate double check of a crew member on the eve of his proposed flight. Average, tests needed to conduct the tests are between 30 and 45 min.

**Oxygen Stimulation**

Professor of the Institute for Thoracic Diseases, Munchen-Grobenhof for 11 staffed Institute for Flight Medicine, German Center for Air Research at Bad Godesberg, Dr. Reiff says that some of "studies" of subjects in his group seem to have effectively proved the validity of the oxygen stimulation theory.

Tests were conducted in a computer van chamber set at an altitude of approximately 25,000 ft., and the candidates subjected to a ritual of the "cotton balls and round peg" routine.

Test subjects were given a series of balls of varying diameter and told to drop them into the corresponding holes placed around a rotating drum. The holes, in fact, opened one shot another for a period of 2 sec. each. Thirtieth balls placed in the finger gripper slots are considered perfect for purposes of the test. At sea level, Dr. Reiff said, his associates found that almost all test subjects, regardless of age, could perform the same task satisfactorily after 10 to 12 min practice.

Candidates taking the test were di-

vided into two broad categories—A, which showed a rapid decline in performance under oxygen stimulation, and B, which demonstrated a slower drop in performance. A factor interpreted by Dr. Reiff as a sign of good adaptation to changing conditions.

**Spacem Disturbances**

Overall results, according to Dr. Reiff, tend to show that the capacity to resist generally increases with age until a person reaches 40 but is also statistically related to disturbances of the physiological means. No differences could be observed between the two groups in a number of factors normally used in de-

termining a person's resistance to oxygen stimulation, including insulation and respiration.

Need for a rapid double check, as he stressed, is considerable prior to space flight was emphasized by Dr. Reiff who gave several examples of young astronauts to stress. In one instance, a pilot showed a marked decline in performance when subjected to insufficient oxygen after recovery from a prolonged shock, although his regular medical examination had failed to indicate any noticeable disturbance from the seven to ten weeks later, the pilot's resistance had returned to its pre-flight level.

In another, a test subject gave usual

**Centaur Liquid Hydrogen Engine Delivered**

Five LR 115 liquid hydrogen engine has been shipped to Cosmic Automation for test and integration with Centaur launch vehicle stage. Cosmic is developing for NASA. Centaur will use two LR 115s (first stage) and four LR 115s (second stage).



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Developed for the U.S. Air Force, this technique has been successfully employed in both tactical and air defense modes currently in production at the Electronics Division.

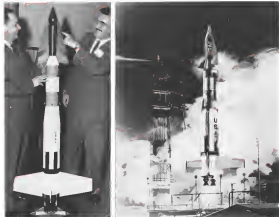
One example is the new, truly 3-dimensional AN/TPS-57 tactical radar. This Westinghouse radar requires little or no site preparation, and successfully combines high data rate and mobility with fixed station performance. Here is another demonstration of capabilities for defense. You can be sure . . . if it's Westinghouse.

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### Model Shows Dyna-Soar on Modified Titan Booster

Model of Dyna-Soar boost-glide space vehicle mounted on modified Titan booster is at left, during air staff's assumption of launching. Lt. Gen. Roscoe C. W. Lee, USAF deputy chief of staff—development, is at left in left photo, George H. Stone, Boeing Dyna-Soar program manager, is at right. Note large shroudless finless booster.

Recent engine tests a strenuous training course, which provided left upper thrust for long periods of uninterrupted sleep showed a very poor candidate. Three months later, after his schedule had adjusted to normal, the candidate's oxygen saturation was described as "particularly high."

Dr. Raff is supporting his theory points out that sections of organisms under stress are triggered by the pattern gland and the cortex of the superior gland.

These sections, "which are far from being understood in all their details, elicit the particular response to its relevant stress—hypoxia, anoxia, anoxia, anoxia, etc."

Since there was no appreciable difference in correlation and response under oxygen starvation between the superior and inferior glands tested by the scientist, Dr. Raff assumed that the explanation must lie with the reactions of the posterior gland and the cortex of the superior gland.

After activation of the cortex of the superior gland and expansion of its functions, the quantity of red coloring matter in the blood stream decreases and here Dr. Raff found a substantial difference between the two groups. He told the ICAS:

"When the doctrine is compared between organisms A and B also oxygen starvation, it is found that significant differences arise between them if the three of stress is constant for all three tested. The B type, i.e. more resistant candidates are subject to a slighter decrease of red coloring matter and have a more rapid adaptation. This must be associated with the activation of the cortex of the superior gland."

Considering the different reactions of the cortex of the superior gland under oxygen starvation in groups A and B, Dr. Raff concluded that "candidate under lack of oxygen is related to reflect sympathetic stress." He said examination of the same person under conditions of heat, cold and oxygen starva-

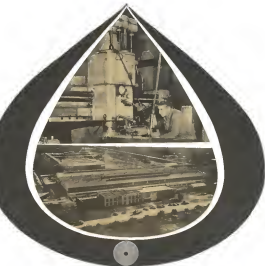
tion "has so far confirmed this theory. Although subject to other stresses, the candidate remains in the same color group."

On the basis on these results, Dr. Raff concludes that, usually, at their selection depends on endurance under stress, it would not be necessary to subject all new candidates for constant blood records to the widest possible range of resistance tests.

Oxygen starvation reflects as a test of endurance. Its effect on the performance of the human body can be quickly and electrically established, and for the candidate himself, this test is much less unpleasant than heat or cold.

In another report, R. B. Hildebrand, chief of advanced systems research at Boeing Aerospace Co.'s AeroSpace Division, presented an analysis of the problems of survival against air attacks of greater than 25,000 ft., with emphasis upon the human system response.

For recovery of a human system, Hildebrand considered two possible trans-



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inner-disk in which the whole approaches the earth in the same direction as the earth's rotation and retrograde, in which reverse is made in a direction opposite the earth's rotation.

### Two Trajectories

He attributed these characteristics to the two trajectories:

- **Direct return flight** at lunar launch velocity, 8,000 fpm, launch angle, 39 deg.; flight time, 2.25 days.
- **Retrograde return flight** at lunar launch velocity, 8,000 fpm, launch angle, 34 deg.; flight time, 3.75 days.
- **Direct return earth reentry** with single reentry to launch velocity, 0.8 fpm, orbital velocity, 30,200 fpm, side over velocity, 31,000 fpm.
- **Retrograde return earth reentry** with single reentry to launch velocity, 1.2 fpm, orbital velocity, 30,200 fpm, relative velocity, 37,740 fpm.

Haldeman concluded that lifting as much of one form or another, possibly will be needed to reduce velocities and broaden the horizons of the return corridor, which is determined on the one extreme by the altitude at ship launch and on the other by the acceleration, turning and/or acceleration limit.

Thiel's International Congress of the International Council of the Astronautical Sciences is scheduled to be held in Stockholm next year during the week of Sept. 10, following the 22nd Third Division of the Society of Astronautical Engineers at Edinburgh.

## Czech Centrifuge Turns at 6 Million rpm.

Washington — Czechoslovakia has built an ultrahigh speed centrifuge which turns at 6 million rpm and will be an important tool in basic research on particle physics.

The new centrifuge, which has been exhibited in Moscow according to the Soviet magazine, *The Economic Gazette*, has its vertical rotor casings independently suspended and stabilized by an electronic system. An electric control of 100 kc frequency drives the rotor and it turns at a constant diameter with a precision on the order of  $10^{-4}$  mm.

Centrifugal force created on the periphery of the two cylindrical rotor shells is so great, which is designated Type CC 2, it is high enough to overcome the head strength of the strongest adhesives and polymer coatings. It is also to be used to study the structure of variable dielectric, the separation of mixtures and the mechanism of the coagulation of mixtures. It is expected that this machine would be of great benefit to development work on reaction fuels, high temperature materials for aircraft and space vehicle nose cones and chemical fuels.

## Two Systems Aided Sputnik V Recovery

Moscow—Two separate declassification systems were used during the recovery from orbit of the three piece Sputnik V satellite, which crashed two days and eight tenths (NAV Aug. 28, p. 28). The first Russian national satellite is scheduled to use these two declassification systems along with the Moscow procedures used on Sputnik V.

Reentry and recovery sequences of the Sputnik V recoverable satellite consist of four major operations:

- **Retrograde** is fired to decelerate the entire free fall vehicle and bring it down out of orbit.
- **Recoverable** vehicle protected by a heat shield is separated from the main crew, cable restraint section immediately after the retrograde stage firing.

Second declassification system is initiated to further slow the recoverable cabin. Operations of the system has not been detailed by the Soviet. Retrograde or atmospheric drag brakes could be employed. This declassification system is used from an altitude of about 700 mi down to about 4 mi or around 30,000 ft. Maximum loading during the declassification is 10g according to the Russian and the ground distance covered is a little less than 7,000 mi.

• **Capable** continuing the firing occurs until the Sputnik V can reenter from the recoverable cabin between 30,000 and 25,000 ft and both sections decelerate to descend to the ground by parachutes. The descent rate of the cabin is specified at 12 ft/sec and that of the recoverable capsule is reported to be in the neighborhood of 25 ft/sec or faster. Parachute descent rate called for on the U.S. Project Mercury capsule is 18 ft/sec.

The last portion of the Sputnik V recovery sequence was actually included in the design as a reserve system to be used if the parachute on the recoverable cabin failed to open. Meanwhile the recoverable capsule would not be ejected from the cabin.

Two major advantages are apparent in the procedure of designing a recoverable satellite in two main parts. First, the weight of the heat shield necessary to protect the cabin during reentry is reduced considerably by decreasing the weight of the instrumentation and power supply before reentry begins. Second, the size and weight of the second declassification system and the recovery parachute is substantially reduced because a major portion of the satellite's weight is dissipated before, thus, are employed.

During the reentry, the attitude of the Sputnik V recoverable cabin was controlled by a system of gas nozzles actuated by a stabilization system.

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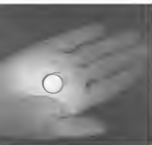
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# Kodak and the eye

In the course of maintaining ourselves as the world's best-equipped organization in everything related to photography, we have gone down some interesting bypaths.

One of these paths, some years ago, led to the production of surfaces of reflective surfaces like this:



They're very simple optical devices that turn a light ray back on itself regardless of the direction it came from. You once saw them everywhere forming the letters on highway markers. Though very cheap, their optical quality was amazingly high. (Too high, in fact. They tended to return the rays once to the headlights themselves rather than to where the driver's eyes were. We fixed that.) After a few years of vast expense in this market, we were knocked out of it by a better idea—microscopic beads that did the same thing while dispersed in a



medium that could be applied like paint. That's what is seen on the highways today.

The world moves on. We are back on the subject of sending light to the eye, but with a sophistication far beyond that required for night-bright signs or animated advertising displays.

This comes about from our involvement in problems of picking up visual information from places where a human eye cannot or should not go. In such problems, it is not worth relying upon us if plans depend upon TV cameras will do. We step in when it becomes desirable to broaden the talents of the simple TV camera tube with precision optical devices and with precision mechanized devices. In principle, the optical devices do it hardest; the first TV lenslight was Kodak's, and so was the first TV gunlight that may well generate the brave old games on a board in an honorable place in the military arsenal where they show the home-mounted knight in shining armor.

The intentions required were made by Kodak at its own expense and then further elaborated by Kodak to create this television eyeball on the grounds of North American's All-Vigilante Attack line where the occupant look around at their external environment.

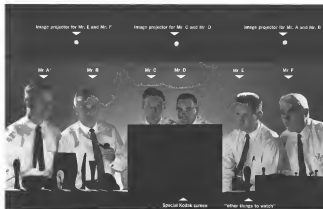


But television eyeballs must eventually feed into human eyeballs. There is more to be done than putting

the image on the face of a cathode-ray tube. Space is at a premium. Small tube faces need optical magnification. Magnification loses light.

Kodak has found a way to direct the precious light into the eyes of the watchers and not waste it elsewhere. Brightness is several hundredfold improved over the situation where the light is simply thrown out from the projection screen into the room in hope that somewhere a pair of eyes will catch some of it. The smaller the space from which the eyes may watch, the more the gain in light.

Below is a demonstration, by the engineers who worked it out, of a screen material which can be given the ideal reflection characteristics wanted in any given projection situation. It permits the shape and size of the audience space to be exactly specified in relation to the location of the projector. It permits several audience spaces simultaneously from several different projectors, each audience seeing a different image on the single screen. Nobody's image is washed out by ambient light or somebody else's image. The entire viewing situation is preset by the microstructure of the projection screen and



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**EASTMAN KODAK COMPANY, Apparatus and Optical Division, Rochester 4, N. Y.**



First stage of *Isana* vehicle is prepared for insertion on *Isana* Vanguard launch pad at Cape Canaveral, Fla. The stage is serviced and oriented by a boom armful of 3 guides. Photo at bottom right on opposite page shows progress of the first USAF Blue *Isana* 3 research and development vehicle. This vehicle tested launch technique (AW Sept. 15, p. 29).

Blue Streak Jr. instantly reacts to mounting position until T-40 gun. Jet's shows makeup of four-stage solid-propellant vehicle.

## USAF's Blue Scout Jr. Tested Launching



Blue Scout Jr second stage is a Hercules A80-2194-33 solid rocket motor. Hydrogen peroxide rockets control pitch, roll and yaw. Blue Scout Jr was first vehicle to be fired in the Hyper Environmental Test System (HETS) GNA program. A HETS GNA vehicle is intended to carry a 100-lb. (45-kg) model to 300,000 ft. altitude and speed of 22,000 fps. next spring.

Small spin sockets on the first stage (above) are used on launch in similar socket. Unguided Blue Scout Jr. is launched at 70-deg angle unlike other models to be launched vertically.



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direct accessory equipment assignments. • The ability to employ many control buffers gives new meaning to expandability in the Bendix G-20. Up to 70 input/output units can be directed by each of these "line supervisors." The Bendix G-20 has a complete line of accessory equipment including keyboard, paper tape, punched cards, high speed line printers, and 2 million word magnetic tape units. • Memory represents another dimension of G-20 expandability, ranging from 4,096 to 32,768 words. • Investigate the organization chart design of the Bendix G-20. See how it provides balanced, practical expandability — at a cost that assures unequalled data processing performance per dollar invested. • For detailed literature write:

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# Mercury Landing System Tests Completed

Washington—Rocketdyne has completed qualification of the Thorax Mercury capsule landing and recovery system in National Aeronautics and Space Administration's manned satellite program space tests of critical flight test stage.

Flight Mercury development schedule requires subsystems to be developed and proved incrementally with the development and entry flight testing of the capsule (AV Aug. 8, p. 24) so a full-scale test, integrated capsule entry will be made for the first manned bellhop flight within the next four months. Bellhop flight tests of the capsule system with landing and delta heaters are scheduled before the first manned flight.

## Test Program

Mercury landing system was developed and tested during an 18-month program conducted by Rocketdyne Division of the Northrup Corp. under sub-contract to McDonnell Aircraft Corp. System has been accepted by McDonnell and NASA.

Two-stage Mercury landing package uses improvements of existing equipment and the 18-month Rocketdyne effort has been aimed at a parachute landing system with maximum reliability. Development and test were accomplished with such one failure in 50 aircraft drops using bellhop capsule ground models of the capsule (AV Feb. 15, p. 12).

Success reliability which Rocketdyne sets at higher than 99%, also has been demonstrated by its use in 72 flights in NASA's on-off pad short little Joe Big Joe and Allen tests of engineering and production capsules.

## Single Failure

Single failure in the Rocketdyne program occurred on the 41st drop in a test of the effectiveness of the reserve parachute. The main reserve parachute was activated, disconnected, and when the reserve chute deployed, the former was closed by a dump valve on the reserve section. The reserve model fell 6,700 ft., broke apart on impact.

As a result of this test fittings on parachute capsules were rounded or blunted to eliminate potential hazards of sharp edges.

Mercury landing package consists of a shroud, parachute main and reserve reserve chutes, aerosol and jettison aerosol explosive activation and recovery aids. Normal landing sequence begins at 43,000 ft. following capsule recovery from orbit. The aerosol activation system then shroud was closed on the

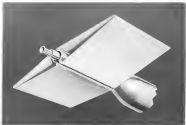
trial ascent to open a master shell covering the 5 ft. ribbon drag parachute. The drag chute, first stage, in the reserve, rapidly inflates to stabilize the capsule and to slow it from Mach 1 velocity to a true airspeed of 160 kt.

The drag chute, which is inflated basically as a means of stabilizing the descending capsule initially was positioned to deploy at 60-70,000 ft. As actual flight experience was refined,

42,000 ft. was found to be the best altitude at which to inflate it.

At 10,000 ft., the drag chute opens the second-stage main reserve chute from its pack, jettison drag off with the reserve recovery. Deploying shock of the 61 ft. Ringed main parachute is attenuated in delayed deployment. The Ringed chute remains partially reeled for 4 sec before it inflates fully.

The main chute slows the capsule to



## Rocketdyne Develops Space Heat Radiator

Moving heat radiator for satellites shown in artist's conception above, is under development by Rocketdyne Division of North American Aviation, Inc. Designers say it will operate even if powered by microsecond, burning just below molecular ionization by 21 other bodies. Heat control from waste heat systems can and move continuously to this point heat. Speed can be great in routine constant temperature.





Magnavox continues to maintain a position of leadership in the airborne communications field.

Magnavox engineering, in conjunction with the Air Force, has developed an advanced airborne communications system that is designed to meet the requirements of the future. Utilizing wide band techniques, such functions as television relay for combat damage assessment, data link for control and identification, and many other forms of air-to-air and air-to-ground communications can all be realized over the same equipment as used for voice.

## Magnavox

AN/ARC-50 SYSTEM



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a landing speed of about 30 ft. and is disconnected on water contact by means of an explosive charge ignited by the radio switch.

Range-finder was received by the Navy by Kodak's Edward G. Ewing. Mission Range-finder is a development of the original design, which was evolved from the aircraft's existing Range-finder parachute system. Drop modulus of the Range-finder has been revised to a value of 0.72 compared with 0.55 for the Range-finder.

Recovery and separation began with deployment of the drogue chute, when a cloud of water shell is ejected at 42,000 ft. When main chute deploys at 10,000 ft. recovery control of the Range-finder is complete. Fuel is dumped, airbrakes through pitch and roll control channels, the antenna section is jettisoned and communications link shift to antennas inside the shroud. A small buoy and support (SOS) ARS bomb is dropped, and Strich and Sea-Save remote sensors are activated.

When the main parachute descends, a balloon trailing an HF antenna is inflated with helium and released.

The marker will be either fast-deployed parachute or fast-deployed. Both the air marker and shroud repellent are carried under the capsule test shroud, and they descend on water contact.

Since possibilities are relatively remote that the capsule will cause damage in land water landing has received Kodak's qualification equipment. Since Sea-Save, was used in test use in the Parachutes Group which is special only to capturing results to complete its program of dropping capsule with suspension and component failures built in to check reaction to emergency.

### Laboratory Checks

Since Sea drops were preceded by a theoretical check-out program in which each element received an average of 24 tests to ensure reliability. Components were subjected to conditions of high and low temperature, high altitude, vibration, noise shock and humidity. Tests were conducted in salt spray, sand and dust.

Pyrotechnic charges were dropped from a height of 40 ft. and tested at high temperature. Cartridges underwent 10 min. water test with 15-sec. 6.5 day change to assure that they will not be inadvertently ignited by intense signal light at Cape Canaveral.

Suspension equipment was subjected to 400 min. to test its operation in both normal and abnormal conditions.

An off-the-shelf ribbon drop gas chute originally was planned as first stage for the landing system. Parachute, light drops from a modified Lockheed T-104 aircraft over the NASA High Speed Flight Station at Edwards,

Calif., showed a destructive pulse rate test when the drogue chute was deployed at transonic and supersonic speeds.

The trouble was traced to a "suck" effect caused by air and rebound action of the high-elastic ribbon rate, which produced an inflation and deflation at a rate of 50-50 pulses each second and effectively shook the drogue chute apart.

The 16 ft. ribbon rate was replaced with equal length of Dacron, having less than half the elasticity. Subsequent flight tests using a 1,000 lb. bench device, were made successfully with the new size at speeds up to Mach 3.6 and altitudes as high as 72,000 ft.

## NASA Organizes Division For Materials Research

Washington—National Aeronautics and Space Administration has established a new independent division to coordinate expanding materials research.

George C. Denbick, formerly head of the materials materials branch at NASA's Lewis Research Center, is chief of the new division. Functions of the new division—establishing and managing NASA and contracted materials research and development—materials were previously in the Office of Advanced Research Program.

almost invisibly...



## trouble grows in tired metal

The enlarged photo section at the right has a fatigue crack. It is almost invisible to the naked eye, even though an inch microscope has been used to make cracks easy to see. If the inspector doesn't spot this crack as a method, it will grow and become as dangerous as the one in the picture at the left.

Aircraft uses two separate methods of pinning crack dissemination, (1)

checking structure, followed with a binocular microscope of the critical areas, (2) X-ray inspection. We have some of the most extensive black light inspection facilities in the East.

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## of Falcons

**The Hughes Falcon GAR-11 is the first air-to-air guided missile to pack a nuclear punch.**

Developed by Hughes, the "Nuclear Falcon" adds a major new weapon capability to our defense arsenal. A weapon that can down any bomber in the skies.

Because of its heavy blast intensity and high degree of accuracy, the "Nuclear Falcon" is particularly effective in high-speed encounters against bombers carrying the deadliest of weapons.

The Falcon family has proven itself in operational service—every modern U.S. all-weather interceptor carries Falcon missiles. In simulated tactical trials Falcons have achieved unexcelled records for accuracy and reliability.

Like other Hughes weapons, systems and components, the Falcon is a product of Hughes' unique capabilities in virtually every area of advanced electronics. These include projects in space systems, airborne control systems, microwave communications, data processing and display systems, ASW systems, radar and IR detection systems—and many others.

These advancements in the state of the electronic art are based on foresight, imagination, and proven management capability. Their reliability and operational capabilities have earned them the confidence of users throughout the free world.



Larger than earlier Falcons, yet small considering its nuclear capability, the GAR-11 is 7 feet long, 12 inches in diameter, and weighs slightly more than 300 pounds.

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## Bulova run-away escapements

Bulova's mastery of the mechanisms of time holds practical solutions to some of the growing challenges in defense and industry. One case in point is the Bulova run-away escapement—a simple, rugged and relatively inexpensive device for measuring short periods of time. Currently used in accelerometers and velocity indicators, these mechanisms have wide areas of application yet to be explored.

The artist's conception above depicts a run-away escapement designed for governing the speed of a scan system driven by a microcomputer. The torque transmitted through the gear train rotates the scope wheel which, in turn, oscillates the pallet. The starting and stopping of the pallet at its oscillation acts as an inertia brake

on governor on the whole system.

The detailed equation defining the motion of the pallet is simply

$$T = I \frac{d^2\theta}{dt^2}$$

The initial conditions at  $t=0$  are  $\theta=0$  and  $d\theta/dt=0$ . Integrating Eq (1) twice and applying the initial conditions yields

$$\theta = \frac{1}{2} \left( \frac{g}{T_0} \right) t^2$$

where  $\theta$  and  $t$  denote the half-cycle amplitude and half-cycle period respectively, and the total pallet amplitude is  $\theta = 2\theta_0$ .

In this example, the escapement controls the action of a scan-follower mechanism. The same principle can be adapted to many other applications

such as a timer for closing an electric circuit, a velocity-inducing device used in computers for integrating acceleration-time functions.

Bulova skills come from close association with the involved problems in developing, designing and producing timing mechanisms which fully meet the stringent specifications of the military and industry.



# BULOVA

Bulova Research & Development, Laboratory 160,  
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## Army Describes Communications Satellite

By Philip J. Klaus

Washington—Details of a "beyond-horizon" communication satellite system which bears close resemblance to the Project Advent communication satellite system now under development were reported here by Army Signal Corps scientists who work on Advent during the recent Space Electronics and Telecommunications Symposium.

Like Project Advent, the hypothetical system employs active repeater satellites in a medium orbit at 22,000 mi. altitude and is designed to provide both point-to-point and area coverage, carrying fixed and mobile terminals, including aircraft.

Like Project Advent, the system developed here is intended to grow into full capability in phases or transitional stages. Initial satellite in orbit is calculated here would weigh 1,000 lb., the same as the Defense Department estimate for the first Advent satellite.

Interestingly, the system described here would use ground stations which are nearly identical to those which the Army already has constructed for use with its Project Courier defined repeater communication satellite. The satellite, early version of Advent will be designed to use existing facilities such as these.

James E. Burton of the Army Signal Research and Development Laboratory, who delivered the report here, declined to comment on possible similarities between the system he described and Project Advent or that it differs in the latter are classified. However, he acknowledged that he is working on the Advent program. Report was co-authored by Donald L. Jacobs and George N. Kussner of the same laboratory.

### Limited Capability

The hypothetical system which Burton described would be established in a two or three-step program, starting with a small, low-power satellite of limited capability which would be replaced with higher-power satellites providing more than communication channel capacity plus telephone.

Burton noted the possibility that some channels in a medium communication satellite system or the satellite design itself might be made available to commercial users. Because of the high cost of a communication satellite system, it is imperative that it attract the greatest number of potential users.

both military and commercial." Burton said.

"Resource considerations dictate that ground stations will be located near major communication centers so that they will have to operational capability at the conclusion of research, development and engineering evaluation," he added.

The ground stations which Burton suggests for the first phase would employ facilities which are almost identical to those in the two ground stations which Army has established at Fort Monmouth, N. J., and in Puerto Rico for use with its Project Courier defined repeater satellite (AON Aug. 29, p. 72). Features are:

- Antenna diameter 28 ft.
- Power output 1 kw.
- Bandwidth 1 use per channel.
- Receiver noise temperature 100K.
- Carrier-to-noise ratio 22 db.

### Satellite Characteristics

Communication satellite designed for initial phase of system development would weigh about 1,000 lb., of which 200 lb. would represent communication equipment, telemetry and tracking beam. Shell and structure are estimated at 350 lb., power supply at 250 lb. and attitude station-keeping control system at 100 lb. Antenna system is estimated at 30 lb. with remaining 70 lb. used as inert mass in a safety factor.

Here are the operating characteristics of the initial phase communication satellite.

- Number of channels 10.
- Bandwidth 1 use per channel.
- Frequency range 1,760 to 2,460 mc.

### Advent Subcontractors

Boeing Corp.'s Space Division and General Electric's Aircraft and Space Vehicle Dept. are the two major subcontractors in the Project Advent communication satellite awarded for system development study. Boeing will develop the communication payload, including receiver, transmitter, command and control equipment, a stable GFI with develop satellite vehicle shell and its electric power supply. Fifteen groups will share the direction of Army Signal Corps. Boeing's contract is with the Army, while GFI's is with the Air Force's Research and Development.

The advanced communication satellite will require continuous power supply of about 1,000 watts. This, too, power needs of the earlier version,

(The same as for Project Courier.)

- Power output 1 watt per channel.
- Antenna gain 24 db.
- System diameter 20 ft.
- Receiver power 100 watts.

To provide maximum coverage capability, the initial phase satellite will use multiple narrow-band channel design so that it is capable of 30 different radio frequencies. Fifteen or more channels will not cause loss of a number of satellite capacity. Transmitted output tubes will be modulated which will be operated with sharp channel output levels to provide long life.

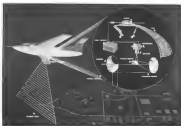
At the selected operating frequency, the 20-in. diameter antenna would produce a beam approximately 20 deg in width, capable of illuminating about one-third of the earth's surface of the polar area. Antenna will be fixed to satellite shell and will depend upon satellite attitude control to keep it aimed at the earth, but within an estimated two degrees. Station-keeping controls would be designed to keep satellite in its desired latitude-longitude within two degrees.

### Advanced Version

The next, advanced communication satellite is expected to weigh about 1,800 lb. of which 1,500 lb. is allocated for the communication equipment. The larger payload will provide increased bandwidth 400 mc. total compared with 16 mc. for the earlier version. To obtain necessary communication capability operating frequency is expected to move up to the 4,400 to 5,000 mc. region.

By using traveling wave tubes in the satellite to give an output power of five watts per channel, an increased (100 mc.) band channels will be allowed. Each will be capable of supporting 1,000 commercial or unclassified voice channels per polar hemisphere channel. When operating is required for military use, each hemisphere will provide 100 voice channels or more for TV.

Satellite will use an omnidirectional omnibeam antenna with a diameter of 3 ft., giving a beamwidth of about 2.5 deg. This omnibeam antenna beam will provide increased directivities, and thus privacy, for military communications. However, it will require greater precision of control of satellite attitude and position, both to within one-half degree. Burton said. The advanced communication satellite will require continuous power supply of about 1,000 watts. This, too, power needs of the earlier version,



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Science Park, State College, Pa.



would be supplied in combination of solar cells and batteries.

A third generation communications satellite, still still more power efficient central may be equipped with a 20 ft. diameter inflatable parabolic antenna. This larger antenna coupled with a dish to a still higher operating frequency, in the 10,000 to 10,000 mhz band, would provide even greater directivity and gain.

The third generation satellite might be powered by a solar-powered fuel cell. Working medium would absorb solar energy and decompose into ions which would pass through the fuel cell and produce electricity.

To achieve increased bandwidth demands, improvements also would be required in the feed ground station. Transmitter power would be increased from 1 kw to 10 kw, and 50 ft. diameter antennas, with 50 db gain, would replace the 28 ft. models and with earlier version. Mobile stations would employ smaller transmitters and antennas.

### Reliability

Initial versions of the communications vehicle, would be expected to have a useful life of one-half year to a full year. With use of individual components, an advanced model, it should be possible to extend useful life to two years or more. Future indicated.

The communications vehicle, as described "appear to be attainable, in the next few distant future." But, and "Early evaluation of a limited capability system will be followed by higher capacity, more advanced system satellite, for operational use, would be located near the future. Timely coordination of the actual satellite, and commercial requirements will result in an effective development program and an optimum system design," But, concluded.

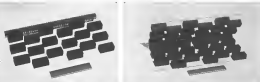


### Security Adapter

Security telephone adapter placed over telephone handset automatically, automatically giving message and information receiving security from other security telephone ability to use. No wires or connections to telephone handset are required. Device employs 16 transistor circuit, weighs 2 1/2 oz., contains built-in battery power. Manufacturer: Defense Corp., 949 Industrial Ave., Palo Alto.



**WELDED PACKAGES** under study at Autonetics would use stacked, cross-hatched components mounted in a structural failure around periphery of a microchip and be accessible for replacement. Proposed microchips would be of same size and layout as now, at left, but would employ stamped wiring with leads welded to base metal instead of wire bond together with microchips. Stamped wiring is made by slitting a standard pattern from a light weight, flexible ribbon with a roll die. During handling, this flexibility in center cut of new component protects along length. For on and on heat up simultaneously. First form of stamped wiring based lead technology shaped glass coating covering the board except on periphery where connections are made to components, and has center supporting ribs riveted in and edge of silicon bond removed.



**WELDED AUTONETICS** microchips will be dip-soldered on two-sided etched board in checkerboard fashion to form a half module. Connections among adjacent modules will be made by soldering wire leads to the other to form a half module. Connections among adjacent modules will be made by soldering wire leads to the other to form a half module.

## New Component Packaging Idea Studied

By Barry Miller

**Danbury, Calif.**—General concept of packaging conventional analog components into digital computers which may combine the features of high adaptability, compactness and low cost with a simple, one maintenance, has been explored here at the Autonetics Division of North American Aviation.

Basically, the concept dubbed Danbury Package Revised Standard Elements (DPRSE) is a variation of the well-known, or welded module technique.

(AW Aug. 24, 1959, p. 104) study, an advantages outlined, covers the advantages attributed to the use of available, stamped, quality, level components and flexible, standard techniques, of being practicable now. Indeed, welded packages already are employed in more than a dozen companies in a variety of programs including the construction of guidance computers for the aerial navigation of the Titan ICBM and the fleet ballistic missile Polaris.

The welded package is a method of night packaging components into modules much like standard high-level analog descriptive study-log, packages used in degrading the technique. Interconnection of components are made not by soldering but rather by controlled electrical resistance spot welding similar to that used in making electronic electronic tubes. Spot welding offers the advantage of a quick heat cycle which permits connection of components in close proximity without fear of damage from excessive heat.

Using the earlier related pack approaches, the Autonetics concept does not use as yet the potting normally which other approaches find necessary for structural rigidity as well as component protection. Its components are, assembly, located on the periphery of the circuit board, and consequently, it does not use maintenance and individual component replacement rather than the expensive discarding of an entire building block.

William A. Farnand, Autonetics engineering manager, said the concept is still in the hardware stage. But, he says, the use of process techniques and conventional components whose reliability is not in question should be able to reduce the concept to production practice in 12 months. Particular attention is given the DPRSE concept and conventional components, Farnand adds, and those chosen for the microelectronics approaches which must use quantum new technologies and/or use of relatively unknown micro components.

At least for the present, Autonetics is doing work with standard printed circuit techniques for the guidance computers of its major effort—developing guidance systems for the Minuteman intercontinental ballistic missile. For example, both Farnand's work and a separate microelectronics program would be used in later equipment should they be found.

From an analysis of Autonetics' comparison Farnand concludes that have

most responsible for the DPRSE concept, emphasizes that it is still in the concept rather than the hardware stage. But, he says, the use of process techniques and conventional components whose reliability is not in question should be able to reduce the concept to production practice in 12 months. Particular attention is given the DPRSE concept and conventional components, Farnand adds, and those chosen for the microelectronics approaches which must use quantum new technologies and/or use of relatively unknown micro components.

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standard submodules can be built without paying too great a penalty for standardization. Each submodule in the DENSE concept represents some basic function as a portion of one, such as a flip flop, word or code amplifier, logic module, cable driver, etc. The submodule would have approximated dimensions of 1 1/2 in. in length, 1 in. in width, 1/2 in. in thickness and could accommodate a maximum of 25 standard internal components in given positions (this would provide component densities in excess of 300,000 components/inches when all 25 portions are used). Components are dropped into slots between two parallel stamped wire boards which are released ties and are then welded to take it out slot.

The three-step DENSE construction approach is as follows: standard wiring patterns for interconnection of components in basic submodule concepts are repetitively blanked out of a long, narrow (the extent of 1/2 in. width) metallic ribbon by a roll die. As the pattern is being stamped, tabs on the ribbon to which components will later be added are turned up normal to the surface of the ribbon. The resulting pattern on the ribbon is a standard all dollar pattern with the various metric patterns being the essential conducting paths between elements. This stamped wiring daisy pattern has an outside connecting edge to permit it from crisscrossing during handling.

### Copper Ribbon

The ribbon is made of hafnium copper, a component of a good weld metal and one which can still take solder. If a light weight and in production will be cheap.

After a glass covering is placed over the entire portion of the ribbon and exposed to it to hold the sections together, the connecting edge is then sheared off. Two pieces of this stamped wiring board are drawn back to two are called are joined together by two center studs which are reacted into both pieces.

Then, the basic submodule structure—usually, two stamped wiring boards held facing one surface and separated by two studs stands less than 1/2 in. in height. Components can then be placed around the periphery of the module with their axial leads crossing against slots in the wiring boards. Transistors are not placed back-to-back as they are in a surface-mount approach but are supported by the strength of their own leads. A maximum of nine components can be placed along either length of the module, five on the ends. Component leads are then be welded to their respective tabs. All components are oriented on a 1/10 in. grid centers.

Because the submodules are structurally sound, formed tape, encapsu-

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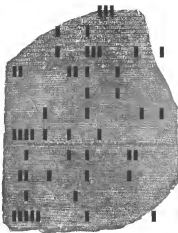
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The Rosetta Stone provided secrets that had been buried for centuries. It bridged the gap between known coveilation and unknown, ancient Egypt. The discovery of the Stone was an accident, one of those curious events that sometimes happen. So Modern science faces a language problem much more complex than deciphering of hieroglyphics. And once again a Rosetta Stone is needed. But science cannot wait for an accidental discovery. Each branch of science has its own language which it uses to state problems. And electronic computers can solve problems only if they are posed in the language of the specific computer. Translating science languages into computer languages is continuously evolving in time and money UNCOL (Universal Computer Oriented Language) is a feasible solution. The development of UNCOL will bridge the gap between a multitude of Problem Oriented Languages and a growing number of Computer Languages. UNCOL is one link which occupies a critical link in System Development Corporation's SYSTEM DEVELOPMENT CORPORATION. A non-profit scientific organization developing language computer based command and control systems. Staff members at Los Angeles and Santa Monica, California.

tion of the carrier assembly is not necessary and components can be cooled by air induction. Finally, components in a functioning assembly can be located without heating; they are on the outside of the substrate and exposed. The substrate components can be soldered rather than welded into the assembly so that location of a replaced component can be noted from the soldering point.

### Consent Follows

When a component fails in either wide-pack approaches a host company's overall structural strength of the pack, the philosophy calls for describing the entire pack. At least the putting component will crack and split components. Use of this three-axis philosophy is a matter of logistics for a particular up-plexion. Costs of three-axis units at times become staggering. For example, an engineer from Squipia Corp. is pioneer in this field, has stated that costs of these units he has worked with would run up to \$1,700 a unit in production.

Further studies however, that it is not certain that welded joints without encapsulation will prove sufficiently reliable for Autoclave use. Should they fail to be, a more complex weld structure which uses a redundant non-stressed weld may be considered.

To interconnect functions, subunits are added in a reaction based fashion onto a pre-defined critical bond in such a manner that components of these subassemblies are secured to the critical bonds. The former a half node and the latter an interconnection are made among subassemblies on the critical bonds and the subassemblies are control with polyelectrolytic the modules. Two half modules which are incompatible to each other can then be subdivided to allow to form a feasible approximation. In short, the two half modules can be linked together through the shared of the subassemblies and screen physical steps. The result is an extremely light but mechanically strong unit.

### Standard Connectors

The modules use standard printed-circuit-board connectors. Each module occupies 1 of two connectors at a sacrifice in space. Forward view, one gets a module with modular output sockets, thus protecting the connectors from environmental damage.

At the end of the trial, Farmer says a flip flop has been made and test satisfactorily. In addition, a computer program using this approach and recording 4 x 5 m on a 1 m center has been laid out.

Hand assembly of and testing individual submodules is a relatively simple procedure. Forward points out. The assembly can be completed with a small

### Transmitter-Receiver

**Model number 7014** Manufacturer: Northern Radio Co., Seattle, Wash.

soluble, placed next to unfilled tub made. Then a maximum of six components can be inserted in respective state as indicated by the master. Welds can be visually inspected. In fact, welds spotted more quickly than faulty solder joints. Units too slow to turn into a house and tested.

To assist one another in developing and to exchange information on building packaging techniques, a number of companies active in solid packaging have organized an informal committee which has held three meetings during the past year—the first at American Bosch Aracruz in Garden City, N. Y., the second at Suprema Corp in Miami, Fla. and most recently, the third meeting in late August at Automática Inc. in Dosage.

[illegible]

Higher International Research Machines, Koorbitt, Little Lockwood Motors, MIT Instrumentation Lab, Kensington Road Unit, Spitzer Space Technology, Labs Space Concepts, Walter V. Sterling, Johnson Electric, and Westinghouse. In addition, Demand Ordnance Fuse Laboratories also part, in the representation of the Navy's Special Projects Office and the Air Force Ballistic Missile Division.

A major problem confronting growth of the welded packaging approach is the growth of components which have loads with surface welding tolerances. The industry committee at its last meeting set up a group which will attempt to start with component manufacturers in an effort to get them to make compo-

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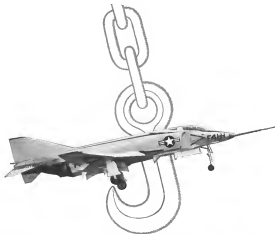


## ACF's CHECK LIST FOR DEFENSE PROCUREMENT

- ☑ **engineering:** American Car and Foundry's engineering staff is trained to design from rough plans, develop the product to meet performance standards and create the processing equipment which will achieve the most efficient production.
- ☑ **manufacturing:** Five huge plants offer advanced facilities for tooling, heat treating and fabricating both ferrous and nonferrous metals and modern alloys.
- ☑ **research & development:** From initial drawing to prototype, through pilot or full plant production—sound, modern, workable products.
- ☑ **quality control:** Every phase of the manufacturing process is inspected by up-to-the-minute equipment and techniques to insure highest standards of quality and performance.
- ☑ **experience:** Ammunition • Armored vehicles • Propulsion system components • Ground Support equipment • Transportation equipment • Communications hardware • Research and development

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# "SKY HOOK"

*Landing speed of the McDonnell F4H reduced 8% by Solar built boundary layer control system*

**BOUNDARY LAYER CONTROL**—achieved by bleeding air from the propulsion engine and directing it at precise speeds over wing control surfaces—enables by 10 knots the landing speed of McDonnell's F4H fighter.

Designed and manufactured by Solar, the F4H boundary layer control system makes possible safe, efficient carrier landings. Made from high

strength, heat treated Inconel X, the lightweight system weighs only 66 lbs. It is tested to 175 psig and operates at 775F. Ducting wall thickness is .012 in. A special design feature allows passage of the ducting system through folding wing joints.

If your needs involve this design, testing and production of complete ducting systems for aircraft or missiles,

ask us Solar's proven capabilities in the field. Write today to Dept. H-100, Solar Aircraft Company, San Diego 10, California.



strength which are suitable for welded assembly. While most lead materials can be welded, Earned says the time and money that would be lost if a various manufacturer had to decide just how to weld each component would offset the value of welded packaging.

Ideally, essential parts should be made in a few lead structural materials to reduce production time. However, since a selected, all leads should be made of the same material.

## Instrument May Speed Missile Tracking Data

**SORBIT** is the oriented real-time tracking instrument now under study by the Army, which expects an attempt to provide accurate, continuous missile tracking data for analysis and possible in-flight correction.

Radation Inc., Milwaukee, Wis., will develop the design of the tracking system under its Air Force study contract. SORBIT, utilizing star positions for orientation reference, attempts to combine the accuracy of ballistic camera tracking with the continuous nature of radar systems. Directed beams of the video is now aimed at one at 20 degrees per second rate.

In present SORBIT concept calls for an electro-optical mechanical system in the field plane of a battery camera lens is a mirror that focuses a photomultiplier detector tube. A rotating mirror allows scans of the field in the X and Y planes. A lock bell to the mirror rotation marks occurrence of angular rotation and its output is generated by the detector tube to pro-

vide an accurate reading of the angular displacement between two colored light sources—the missile and a known star. The angular position of the star at any instant of time will be indicated by an IBM 7090 computer. The SORBIT system is intended to provide accurate missile location with a combination of error caused by atmospheric refraction and instrument misalignment.

## ENTER FILTER CENTER

**Minuteman Component Reliability Backup**—Aerobics is seeking various shorter sources to provide information in backup for those being supplied to its Minuteman guidance and control system. Reliability program (AW Oct. 10, 1959 p. 59) by General Electric, Motorola, Fairchild, Transient and Delco. Additional supplies want contract to meet stringent manufacturing and reliability criteria as the present Minuteman component subcontractors. Backup for diode sources is being considered.

**Texas Reliability Incident**—Hoffman Electronics reports that a Texas unit, at a following in Air Force was exhibit 148 by. Information between incident (MEDI) when subjected to the program. MEDIE test program. The Hoffman MAN-71C becomes the first complete program to handle the high MEDIE tests under which radar would Texas components showed only 17% between failure. In field use, component is expected to exhibit one or two faults (AW June 15 p. 57).

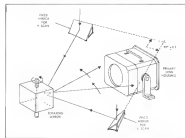
**Bus Area R&D Equating**—See Transient Bus area continues to be in active location for various and space technology companies. Arthur D. Little, Inc., Cambridge, Mass., research organization active in several space programs is now shopping for lead for a research facility on the bus program. United now Little's main specialization in the West Coast area was provided by consulting efforts. One of the several outlets on the program is the recently organized U. S. Systems Development Laboratory in Palo Alto. Joined by a small group of related specialists previously with Bell in Palo Alto.

**Transient Sales Total Customers**—Transient sales for July were 71 million units, an increase of 41% over the same month of 1958 compared with a 120% increase in transistor sales in July 1959 over same month in 1958, according to Electronic Industries News figures just released. Dollar sales in July this year were \$18.1 million, 12% higher than the previous year. By way of comparison dollar sales in July 1959 were 100% higher than in July 1958. Latest figures on transistor market saturation is not expected by American Wire Sales. April sales figures were released (AW Aug. 1 p. 71).

**First Antenna Breakdown Study**—First of three Nike Cajon radar tests which will carry instrumented studies conducted by Stanford Research Institute is scheduled for firing at the Eglin Gulf Test Range (AW Nov. 16, p. 61) in late October. In addition to reports from a program study, the market will carry out-powered X-band and UHF antennas in an effort to study antenna breakdown in upper atmosphere.

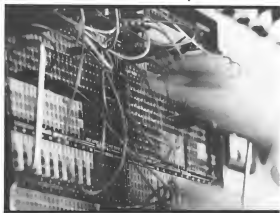
**Infrared Filter Range Extended**—Infrared interference films with sharp cut off that can be placed anywhere between 14 and 8 microns and eventually may be extended out to 10 microns or beyond, has been developed by Spectracon Inc., Belmont, Calif. Company says that films pass at least 60% of the radiation in their passband but less than 1% in their rejection band. The films make it possible to detect and discriminate between objects having very small temperature differentials over the temperature range of -160C to 110C.

**New Photo-sensitive Material**—Developed photoconductive material, for imaging and photomultiplier tubes, which maintains a high sensitivity for years when at operating temperatures above 120C, over the top temperature limit at which such tubes can be operated, has been developed by Westing-



**PATENT** concept for SORBIT instrument under development by Radation, Inc., is shown schematically. Method permits accurate search location with minimum error caused by atmospheric refraction and instrument misalignment, the

# DYSTAC\*



## A MAJOR BREAKTHROUGH IN PROBLEM SOLVING

**POWSTAC**™ Dynamic Buffering Analysis Computer, developed by CSU, incorporates high-speed expensive capabilities with dynamic storage of reading data for no recovery of 0.001 sec. and with a base time accuracy of 753 microseconds. This development has successfully increased the versatility, economy, and speed of solution associated with analog computers. POWSTAC provides unique rate change of computer components and high speed memories. These features make possible numerous and rapid solution of complex problems that have required too many computer components in two loss of solution time to be considered practical in real time digital or analog techniques. Diverse contributions of the two development readily solve problems in four broad categories.

- Sequential evaluation as encountered in the distributed problem. Many sequential solutions in dynamic analysis are delayed from cycle to cycle at a repetitive speed of 50 can solve this problem in a short time.
  - Relatively infrequent evaluation. Varying device integrals are evaluated from one cycle to another and built as memory for the sequential analysis of information problems.
  - Rapid evaluation of multiple solutions. This technique can be employed for the solution of periodic information problems.
  - Current problems and address-external solutions are solved in 10 milliseconds or less.
- For complete information or to arrange for a demonstration visit, please, write, or visit.



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ionic Electron. The material, consisting of sodium, potassium and antimony, has been applied as a semi-transparent surface on a glass substrate and has exhibited photo-response values up to 80 microamps per lumen. Material was developed under Navy Bureau of Ships sponsorship.

► **Handy Chart On Computer Characterization**—Extremely useful compilation of important characteristics of more 47 digital computers now on the market has been prepared by Adams Associates, data processing equipment manufacturing firm. Company's chart is now from the large IBM 7090 (Stretch) to the small Minicomputer. Chart includes such data as price, storage capacity, word size, instruction addresses, add time, access time, plus data on available external storage, input and output devices. The company expects to represent this chart periodically. Copies of the computer characterization chart can be obtained by writing to Adams Associates, 142 The Court Road, Bedford, Mass.

► **Delays Electronics Growth Slows**—Up—Growth of military electronics market, which has risen an average of about 20% every year since the end of the Korean War, is expected to taper off to an estimated 9% growth for next 6- to 10 years, according to Electronic Industries Assn. Prediction is based on survey of more than 50 members of EIA's Military Marketing Data Committee. The group estimates defense electronics spending this year at about \$5 billion. Supplanting this will be another \$100 million in electronic hardware expenditures by Federal Aviation Agency and six military-related \$200 million of the National Aeronautics and Space Administration's \$115 million total budget, Electronic Industries Assn. says.

- **Call for Paper—Call for prospective authors for the following technical conference has been issued:**
- **Winter Conference on Military Electronics**, Feb. 1-3, Los Angeles. Series of "Canadian" (classified) sessions will be included. Send 100-word abstracts and 500-word summaries by Nov. 15 to Dr. Julia E. Myers, Defense Electronics Corp., 3717 South Grand Ave., Los Angeles 7, Calif.
- **Fifth Midwest Symposium on Circuit Theory**, May 2-6, University of Illinois, Urbana, Ill., devoted exclusively to network topology and graph theory, including active and passive networks, linear circuit networks and switching circuits. Send complete manuscript by Oct. 1 to Prof. M. E. Van Valkenburg, Dept. of Electrical Engineering, University of Illinois, Urbana, Ill.

## **NEW** BALANCED WAVE TIG WELDER DELIVERS DEEP, CLEAN "X-RAY" WELDS ON SHEET METAL or PLATE



► **A bold new concept in electrical design and circuitry is introduced in the all-new Miller RWC-300MARC.** One of several notable results is complete and automatic elimination of the 4-c component of all welding currents... an essential in certain critical welding applications.

► **Due to the specially designed transformer, high arc initiation voltage and unique circuit, arc initiation cannot occur.**

► **"Tailor-made" voltage inducer automatically lowers the high arc initiation voltage to a low open circuit voltage—even in case of malfunction of the inducer.**

► **Five independent welding ranges with overlap offer an infinite number of positive, fine-tuned settings—another characteristic of Miller's electrical control that speeds up and simplifies critical welding jobs.**

**EXCLUSIVES—found only in new Miller RWC-300MARC**

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CLIP-LOCKING TURNBUCKLES



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At the all 100-ton  
the ability of the new  
found in lock-and-key  
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**Associated Aircraft Industries**

2810 Joplin Avenue

August 12, 1968



## Barber-Colman temperature controls chosen by leading makers of ground support equipment

Today's air and space vehicles call for a growing array of ground support equipment. Shown below are a few examples of support units employing Barber-Colman temperature control systems. Components include control boxes, actuators, valves, temperature sensing elements, and thermostats. The systems are specifically engineered for each application through the teamwork of the ground cart manufacturer and Barber-Colman. For help on your ground support control projects, consult the Barber-Colman engineering sales office nearest you. Baltimore, Boston, Fort Worth, Los Angeles, Montreal, New York, Portland, Seattle.



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## BARBER-COLMAN COMPANY

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AIRPLANE AND AIRCRAFT PRODUCTS AIR VEHICLE  
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Controlling temperatures of missile guidance compartments and thrusters

Controlling temperatures of missile measurements compartments

Controlling preflight cabin temperatures of jetliners—and many similar processes applications.



MOBILE AIR FUEL CO-SOURCE PRODUCE SYSTEM C-1  
C. S. WOODWARD COMPANY—DOSEL, TX



THE MARK OF QUALITY



1.4, according to manufacturer. Unit is hermetically sealed and has a service life of more than 300 hr. Manufacturer: Thompson, Inc., 2805 Canon St., San Diego 6, Calif.

• Telemetry air signal amplifier, Type 2162, for amplifying output from aerial microphones. Gain is adjustable from 1 to 50. Response is 5 cps. to 4 kc. Output is 15 v. Signal transients are used throughout. Also available: test of event markers, Type 2164A, in this



line's many products. Nominal ramp slope is 0.05 v./ms. but unit is syntonized with other values. Output is 5 v. Device also uses silicon transistors and is qualified for ballistic missile environment. Manufacturer: Electro Development Corp., 2914 University Way, Seattle 5, Washington.

• High-power voltage-variable amplifier, Type Z 5624, has maximum CW power of 50 watts over entire frequency range of 2.9 to 13.2 mc. Similar voltage-variable amplifiers can be designed for 100 mc. bandwidths available in the 2 to 4 mc. range, manufacturer says. Device fits a complete kit package, requiring only tube and output power connections. Tuning rate is about 11 sec./full and plate efficiency is 55% to 60%. Net weight is 4 lb. Manufacturer: Conant Electric Co., Power Tube Dept., Schenectady, N. Y.



• Integral printed circuit switch, called "Thin Switch," is built into printed board utilizing board's conduction. As many as 20 circuits can be switched through a 1 in. diameter hole. Up to 10 switching nodes per track can be piggy-backed. Switching printed circuit boards. Manufacturer: Allen, Allen Co., 141 River Road, Nashua 10, N. H.



## Headsets and other products

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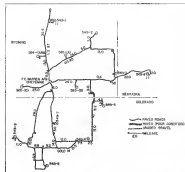


B-26 Superfortress (left) and the Sikorsky HO4S are two of the aircraft competing for mobile support roles at Warren AFB. The evaluation may result in purchase of a mixed fleet of up to 200 STOL, fixed wing and rotary wing aircraft.



## USAF Evaluates Aircraft for Missile

By Wilkes S. Reed



MAP shows the relative location of the launch sites of the 50th Strategic Missile Wing. Base sites are located in the central United States. The sites are in the 19th, however, are widely dispersed and will be virtually unrecognizable at certain times in the winter. Nearly 500 mi. of road travel is necessary to visit all sites by surface transportation. Extension of routes is greatest problem, due to number of personnel involved. Transportation for supporting officers, doctors and maintenance personnel also is required.

Warren AFB, Wis.—Helicopters and light, fixed wing aircraft manufacturers are competing for orders for mobile site support aircraft which soon will be placed in a mobile site survey currently being conducted here by the Strategic Air Command. Probable outcome of the survey will be a recommendation to purchase a mixed fleet of up to 200 STOL, fixed wing and rotary wing vehicles.

Among the light aircraft and helicopters being evaluated are:

- De Havilland L-38, Cessna 180
- Bell UH-1, Sikorsky HO4S, Bell HU-1, Kaman H-43B and Republic Aircraft

The transportation requirement study being conducted is not confined solely to aircraft but will consider surface transportation as well. In some instances, because of time, size or weight of cargo, etc., airlift will not be feasible. SAC transportation officers estimate that surface vehicle travel requirements will amount to about 4 million road miles annually, necessitating replacement of equipment every three years instead of the five years of five years. Estimates as to the number of aircraft required and their daily utilization could not be made because of insufficient data.

A SAC team studying mobile site support transportation requirements is headed by Lt. Col. R. C. McClellan



KAMAN H-43B loads medical defense troops for shift to some of a simulated missile battery 13 mi. from Warren AFB. At right the helicopter, carrying its soldiers and two pilots, hovers at an elevation of 4,000 ft. and with air temperature at 55°.



## Site Support

and consists of four airmen and two major non-commissioned officers, all experienced in supporting long term position requirements. They have set up a central transportation control center in the Warren command post through which all requests for and dispatches of air and surface transport must be made. Future methods are used to record each movement so that the data can be transposed into graph form and fed into a computer for analysis.

### Transport Factors

Consideration of the transportation requirement to support the 13 sites around Cheyenne involves the following factors:

- An distance between the 13 sites, command post and the air base, from 13 to 20 miles; the 10th, the most accessible site in the area on which the air base of the 50th Squadron is deployed. It lies 15 air miles from the 10th command post and with 21 road miles that since construction started on this way, the road has continued to make much dispersing in divided tracks. The 1 x 6 deployment at the 50th will not be repeated elsewhere at any SAC base. The air base deployed in this area of the 50th Squadron (3 x 3) also is readily accessible from the Warren command post. Closest is 12 mi., farthest is 15 air miles and both are 25 road miles from the base.

The three sites were under construction which will have one mobile each, the most critical problem for physical communication. Closest to Warren is No. 7 which lies 22 mi., in air and 13 mi. by road. Farthest of the 50th (3 x 3) sites is No. 14 which is 50 air mi., 67 road miles from Warren. At this time, only scheduled passes are available at the frequency with which these sites will have to be visited once they become operational. Initially, frequency of visits will be high, tapering off as crew experience increases.

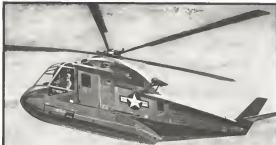
A highway network connecting the Warren command post with the 13 sites comes from the base upon high ways to gaudy, gravel roads possible each summer. Again, the best high way comes available from between the base sites comprising the 50th and

50th Squadron. The sparsely populated and virtually isolated sites on which the missions were placed did not demand heavily traveled super highways, but was it feasible to locate the sites, because of real estate acquisition, close to good highways in all cases? Where this the travel between sites would pose and are the problems on site-to-site travel. In many cases, roads between sites are non-existent or passable only during the winter months.

• Terrain of the sites ranges in elevation from 4,000 to 7,500 ft. mean sea level. The unusually unpopulated regions of most helicopters and light aircraft become critical near this altitude. During hot summer days, it is not uncommon for directly altitudes of 4,000 ft. to ground in the Cheyenne area. Having capability of some helicopters to

Strategic Missile Squadron	%	No. Of Missiles	From Ft. F. Miles (Max.)	Warren AFB Road Miles (Max.)
50th	AMB	6	13	21
50th	A	3	15	24
"	B	3	15	24
"	C	3	19	25
50th	1	1	57	67
"	2	1	57	67
"	3	1	55	67
"	4	1	50	67
"	5	1	51	69
"	6	1	57	62
"	7	1	23	30
"	8	1	46	57
"	9	1	49	65

INSTANCES of strategic missile squadron sites from Warren AFB by air and by road



## Navy Sub-Hunters guided by Ryan C-W doppler navigation

**N**O weapon is more elusive than the modern submarine. For the vital task of detecting these underwater craft, the Navy equips almost every type of anti-submarine aircraft with today's most advanced power type of aerial navigation—Ryan continuous-wave doppler systems.

The world's leader in the design and manufacture of continuous-wave doppler systems is Ryan Electronics. In production are Ryanas® doppler navigation systems which provide complete, accurate navigation information in all weather conditions, over water

or land. And, equally important, this information is supplied without the aid of ground stations or outside data.

This is why—in bombing, reconnaissance, mine-laying and airborne early-warning systems as well as in submarine detection—many Navy aircraft are guided by Ryanas doppler systems from Ryan Electronics.

Ryan Electronics is at work in many fields, creating advanced equipment for today's aircraft and preparing for the navigation and guidance of the space vehicles of tomorrow. In Electronics, too—Ryan Builds Better.



### RYAN ELECTRONICS

DIVISION OF RYAN AERONAUTICAL COMPANY • SAN DIEGO, CALIFORNIA

**RYAN BUILDS BETTER**

comes inoperative at this dense altitude.

• **Windy weather at Cheyenne generally is severe.** Below is the rule rather than the exception and strong surface winds normally accompany severe piloting up to high altitudes. During one summer in recent years, the base, which lies on the outskirts of Cheyenne only about two miles from the center of town, was isolated for three days.

Strong weather also is considered severe Cheyenne has no air reserve and some accompanying instrument clear area during bad weather. VFR area means for fixed wing aircraft require 1,500 ft. ceilings with 3 mi. visibility. For helicopters, VFR conditions can be sustained with 700 ft. ceilings and one mile visibility.

Most sites are considered to be rolling terrain which does not lend itself readily to construction of airfields, even though only about 3,500 ft. maximum is required. A strip is under construction near Warren and also at the site of the 56th Squadron, shortly operational.

However, the strips are and will be restricted to daylight VFR operations since the installation of control facilities, obstruction lights, runway lights, and the problems of snow removal during winter become expected.

#### Basic Requirements

SAC has established seven basic requirements justifying aerial transportation between command post and site and from site to site.

• **Command reassured.** Commander of the 96th Squadron with its 3 x 3 air tactical echelon close to Warren could visit each crew once every 10 days if he drove every day of the week. Commander of the 56th, with its usual wide dispersed 1 x 9 sites could visit each crew once every 20 days. SAC also points out that it is highly desirable that the Director of Weapons Service, a combat-zone maintenance and operations officer, be able to visit the sites regularly and frequently.

• **Reliance of personnel.** The reliance of personnel on the 56th site, closed at the 15, on an 8 hr basis already has been tried and abandoned. SAC presently is running 12 hr shifts and soon will try 24 hr shifts and 45 hr on-station basis. It is quite possible, according to Deputy Wing Commander Col. R. D. Sumner, that crews will be at the site for 48 hr at a stretch. Two crews will be on each site at all times and a new crew will arrive each day. Making the most trip by surface transportation once each day will expose less of a load on the basic transportation facilities and will result in each crew spending less time in transit. Squadrons of the 96th and 56th are manned

by 16-man crews plus a pararescue specialist. Rotation of this many people by air does not appear feasible. However, the transport crew of the 54th possibly will be rotated by helicopter.

• **Medical attention.** Advantages of being able to quickly return an ill crew member to the base and replace him with another crewman are obvious. Doctors and medical technicians are in critical shortage in the Air Force and cannot afford the long hours of travel by surface means necessary to attend an emergency at a remote site.

• **Security surveillance.** Possibility of sabotage or other subversive activity in the vicinity of the sites and along the routes over which missiles, warheads and other critical parts may travel can be considerably diminished by posting air surveillance ahead of the movement of such parts. Additionally, reconnaissance of tactical defense lines can be quickly brought into play in the event of a nuclear mishap.

• **Parts within the range and weight-carrying capacity of helicopters or light aircraft, can be expeditiously delivered to replace out-of-commission items.** Whenever possible, SAC intends to deliver parts on a regularly scheduled basis, but should an MOPK occur (outside area of common for parts), it is essential that the parts be delivered as quickly as possible once the goal is



#### Electrically Heated Rubber Controls Ice

BFGoodrich laboratory rubber units with integral electrical heating elements for heating in cockpit control and sled shapes as well as in the airlines. These units contain ice formation in localized areas such as air switches, knobs, propeller blades and spoilers. Elements are thin, can be applied to almost any shape and are made to order.

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Dept. ATW-1100, Akron, Ohio

## LEWIS WIRE PRODUCTS

TRIFLEX® INSULATED HOOKUP WIRE, -90°C to +150°C  
MIL-W-16227, TYPES I and II

For Wires, Cables and Electronic Assemblies

Modernization and complex electronic assemblies are complicated with the use of Lewis insulated wire. It is unaffected by solvents and temperature, has a low coefficient of expansion and will not shrink in a vacuum or preclude the use of vacuum due to outgassing. It is resistant to chemicals and solvents. Lewis insulated wire provides superior dielectric strength with minimum wall thickness. Manufactured with silver coated copper conductor in 18B and 20B wire ratings in 1, 2, 3, 4, 6, 10 and 12 gauge sizes. 37 thru 42.

#### 600 VOLT AIRCRAFT WIRE TO MIL-W-7109A

A qualified product for high temperature applications requiring superior solvent resistance, high modulus resistance and great stability. Silver coated copper conductor, insulated with Teflon and Teflon/epoxy tape, covered with a Teflon/epoxy coating having a Teflon finish. Area tested in 1, 2, 3, 4, 6, 10 and 12 gauge sizes. 37 thru 42 wire. Also available in sizes 1 thru 22 with a type 302 stainless steel braid applied over all.

• Special treatment.



Specialists  
in High Temperature  
Wires and Cables



# Nav Aid exam 8 miles high

first assignment for the  
Air Force's new C-140 JetStar

America's ability to be constantly ready for strategic and tactical action throughout the free world is linked directly with the accuracy and reliability of our military navigational aids and air traffic control facilities. Now the Air Force has a high-flying electronics lab that can evaluate these aids realistically under operational jet flight conditions. Name of the plane—C-140 JetStar, made by LOCKHEED/GEORGIA.

Five of the new C-140's will go into service soon with the Airways and Air Communications Service arm of MATS. This important assignment is the first operational military role for the JetStar, which was developed by

Lockheed to meet the Air Force's need for a multi-mission jet aircraft.

The JetStar operates nimbly in the high-altitude military traffic lanes. With four Pratt & Whitney J-60 turboprops placed well back on the aft fuselage—behind the eardrums of the crew—the C-140 JetStar achieves Mach 4 cruising speeds. But the new C-140 is more than just quick and quiet. It's a stable platform that assures the accuracy of the sensitive electronic evaluating equipment. And the entire airplane is pressurized and air-conditioned to provide a comfortable working environment for both crew and equipment.

## LOCKHEED

GEORGIA DIVISION • MARIETTA, GEORGIA





## WHO TURBOCHARGED THE DIESEL FOR THE CONSTRUCTION INDUSTRY?

to give you best value first

It's a long way in time and design from the first four cylinder diesel engine of 85 HP manufactured by Caterpillar 25 years ago as compared to today's big but compact Turbocharged, Aftercooled V-12 developing 730 certified brake horsepower. But these two engines have one thing in common—they are the result of searching effort to produce the highest quality diesel engine available.

The acceptance of Caterpillar Engines can be seen in every type of application—protected or in the elements, on land and sea. A major shipping boat manufacturer as an example powers two-thirds of all the vessels he produces with Caterpillar Engines.

Because Caterpillar has constantly strived to improve its products, a good many "firsts" in diesel engine development have benefited every kind of engine user. In addition to being the first to turbocharge and aftercool a diesel for the



**engine  
power**  
BY CATERPILLAR

construction industry, such advances as capsule-type fuel injection valves that can be replaced as easily as a spark plug for a cost of less than ten dollars reveal Caterpillar's direction the building of high-performance, economical diesel engines.

Today, Caterpillar is producing compact, lightweight, high-output engines from ultra-modern facilities devoted to research, design and manufacturing. Cat Diesels are available up to 730 HP and electric set ratings of 400 KW. For profitable use in construction, mining, railroad, petroleum, agricultural, marine, logging and hospital standby electric set applications, choose Caterpillar Diesels.

**CATERPILLAR**

Divisions of Caterpillar Inc., Peoria, Illinois, U.S.A.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

contract lease by Land Air, Inc., located at Claymont Airport. Obviously, this was meant only for assigned Douglas C-47s and C-54s and Land Air personnel are not familiar with jet engines, especially new engines such as the Kaman JH-410.

Down here the Thruster became a problem as Kaman brought in seven maintenance personnel to help at the Land Air facility.

Other assets involved in the program within a similar problem, calculating that the maintenance problem is a local one, rather than being confined to a particular type of equipment.

## FAA Adopts Visual Glide Slope System

Washington—Federal Aviation Agency adopted the British RAE visual glide slope system last week as a national standard designed to guarantee safety and reduce runway incursions.

Selected from five different systems evaluated at FAA's National Aviation Facilities Experimental Center, Atlantic City, N. J. (AW May 25, p. 108) the RAE, or "Red and White," system was developed by the Royal Aircraft Establishment in England and requires no equipment in the aircraft.

NAFEC engineers estimate that a complete RAE system, which FAA will require VLOS for visual glide slope, can be installed at large airports for about \$10,000 at a runway where the field is already equipped with an approach light system and for \$10,000 at other airports for smaller airports where the cost of a full system might be prohibitive. FAA said, an RAE system with fewer lights could be certified for as little as \$1,500.

Using a combination of red and white lights mounted on either side of the runway as the touchdown area, a full RAE system consists of six 4 ft long bars of light on each side of the runway, with one set of three bars 750 ft from the approach end of the runway and the other at 1,250 ft. Lights are enclosed in boxes and are seen by the pilot through a slit in the box. Red lights change the appearance of the lights depending on the angle of approach, with lights below the proper path angle showing all red lights and those above all white. On approaches made on the proper glide slope, the system presents the pilot with a view of the runway bars of light in white and red for the bars at 750 ft.

Use of the system helps avoid the danger of collisions with towers and obstructions in the approach area, reduces the chances of overshooting or undershooting an landing and aids in some situations by helping landing aircraft on a high glide slope angle.

## PRODUCTION BRIEFING

Buskey-Moore Associates, division of Houston Pacific Corp., Tarrant, Calif. will design and fabricate a test track test fixture for ground checkout of the Ranger spacecraft. The test apparatus will be used to check out ground support units for the Ranger space exploration vehicle.

Pacific Aerospace Corp. has opened an Eastern sales office at Westchester County Airport, White Plains, N. Y. The new office represents an effort to increase workload and modification sales of Pacific Aerospace and its subsidiary, Packco, in the eastern United States.

All Ancon Engineering Co., Wilmington, Del., will produce 1,215 spring steel emergency meeting locks for North America. F-390 aircraft. The contract amount is \$750,000, however, the total cost is expected to exceed \$600,000.

ACT Electronics Division, Burnsville, Minn., will build an additional flight simulator of the Republic F-4H under \$1,000,000 contract from AMSC's Aerospace Systems Center. The award brings to five the total number of F-4H flight simulators ordered.

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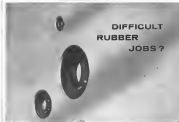
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# Shifting Aims Delay First T.188 Flight

By Cecil Rowland

London—Shift in direction of Britain's major development goals is delaying the first flight of Bristol Aircraft Ltd.'s T.188 all-attack research aircraft by approximately six months from early autumn to second half of next spring.

Speculations associated with the project and the British government's decision to limit its goals for high-speed military aircraft performance plus plans to restrict aerial supremacy transport designs to a Mach 2.5 response have come based to issues the drive for first flight of the T.188, which is eventually scheduled to make beyond Mach 3. As one spokesman said, "You don't just sit there for the doing."

The T.188, had done approximately six years ago is a vehicle to pace the war for future military designs, will now be used primarily as a pure research vehicle to expand Britain's state of the art at high-speed regimes. Present research focuses include experiments with various engine and intake configurations plus studies of kinetic heating, structural stresses and high-speed shock wave formation.

One T.188 design has been given over to the Royal Aircraft Establishment at Farnborough for stress tests. Test flights will be conducted from the Hampshire and Avonmouth Experimental Establishment at Boscombe Down with Goddard Aut. Bristol's new chief test pilot, at the controls.

Initial plans of the T.188, powered by two de Havilland Gyron Junior EC21B turbojets producing 14,000 hp thrust with afterburner, is expected to be between Mach 2.3 and 2.8, ranges already amply explored.

## Will Exceed Mach 3

After the aircraft has passed itself in its aerial design speeds, the range is scheduled to be pushed beyond Mach 3 in progressive steps by the adoption of changes and non-heretofore experiments (ENR Dec. 21, p. 27).

The decision to lower the performance in long wing aircraft rather than turning them in the design or wing was largely dictated by the original Ministry of Supply requirement stipulating that the aircraft be capable of accepting various engine installations in order to broaden its research capabilities.

According to Bristol officials, however, choice of stainless steel for the airframe, which will permit Mach 3 flight, was a fortunate coincidence made initially with little thought of such speeds.



**ALL-STEEL** fuselage and wing section of Bristol Type T.188 (top) must conform at Bristol's Filton works. Wind-tunnel section of engine nozzle diameter. First T.188 is scheduled to begin its test flight program by early next year. Model (below) shows present configuration of all-steel Type 188 high-speed research aircraft under development for British government, including high engine cooling design to take a number of engine configurations. Prototype length is 70 ft; wing span, 35 ft 6 in. Powered by two de Havilland Gyron EC21B turbojets, T.188 will have an initial maximum speed of between Mach 2.3 and 2.8. However, with more powerful engines, probably including ramjets, the aircraft may be pushed beyond Mach 3.



The Ministry of Supply requirement demanded that the aircraft be capable of sustained speeds in excess of 1,500 mph. Bristol knowledge of titanium offers at the time was not, and thus titanium was decided upon as the only

metal capable of coping with the temperatures involved. The T.188's thin wing, which has a span of 35 ft 6 in. and a mean chord of 396 in., has a constant chord between the leading and the trailing edges

profiles. Decked out the leading edge, the leading edge is cupped and is set in an angle of 38 deg and the tip of the wing, located in the balance area of the silent forward of its hinge, has a leading edge sweepback angle of 64 deg.

## Swing-Back Fin

Dual-shaped fairings has an overall length of 71 ft, a maximum width of 1 ft 6 in. and a maximum depth of 4 ft 11 in. In order to clear the engine exhaust, the slab tailplane is mounted on top of a swept back fin.

Another Ministry of Supply requirement stipulated that the aircraft should have a conventional nacelle leading gear as opposed to the wheel fairings of most high-speed U.S. research aircraft.

The leading gear is being constructed by British Messier, the firm, which will withstand temperatures of over 600° F, by Goodrich Tyre & Rubber Co. Ltd.

Improvements to maintain and record aircraft behavior and flight can often will be located in the fuselage. Some indications will be recorded and

stored in the aircraft for examination after landing, and more will be tele-transmitted to the ground during flight.

By weight more than 90% of the aircraft will be in the construction of the T.188 were fabricated by Firth Vickers Stainless Steel Ltd., of Sheffield. Just recently closed by Firth Vickers and Bristol also led to the development of two new steel for possible use in future high-speed aircraft. Their development, however, came too late for incorporation into the T.188.

Stainless steel plates for the nacelle's skin was supplied in relatively large sections in order to meet an extensive number of joints. Rolled bars were and its bolts, fasteners and other fittings. Special design was required by Firth Vickers to be the largest steel forgings for aircraft ever made were developed for the engine nacelles. High tensile forgings were used for the wing attachment points.

Knot bases of the aircraft is formed by a single 27-ft-long steel forging. Stainless steel piping also is used on the T.188 for the hydraulic system, which powers the leading gear, flaps and controls.

## RAF's Sprung Seat Platform System May Isolate Pilots From Vibration

Investigation at the Royal Air Force Institute of Aviation Medicine of the effects of vibration on pilots have led to the development of a simple and compact seat suspension platform which is completely isolated from external excitation. The sprung seat platform, which was developed at the Royal Aircraft Establishment, Farnborough, is thought to be the first sprung system that provides a stable point of zero velocity for a supported seat at a particular datum position in 10 to 15 deg body degrees of freedom (roll, pitch, yaw).

No application of the system has so far been evolved but it appears that the RAF seat is designed for the T.188, which was developed at the Royal Aircraft Establishment, Farnborough, is thought to be the first sprung system that provides a stable point of zero velocity for a supported seat at a particular datum position in 10 to 15 deg body degrees of freedom (roll, pitch, yaw).

## System Fundamentals

Principle of the system depends on the fact that if the control frequency is considerably in excess of the natural frequency, the amplitude of the displacement is small, attenuated. Reducing the stiffness of a spring system lowers its natural frequency and in the limiting condition of zero stiffness, the natural frequency becomes zero and hence minimizes the system loss in external excitation.

Absolute zero stiffness cannot be achieved in any practical application because it implies that the seat is not attached to the structure at all, no restraining force. This condition can be approximated for most applications by providing a nonlinear stiffness characteristic that provides a near zero stiffness in small displacements with a rapidly increasing stiffness as the displacement increases. Providing the range of low stiffness es-

sues the amplitude level of trouble-making vibrations is limited, then no harm is achieved for both lateral and rotational motions.

One system developed by W. G. Morrison at the RAF employs three sets of helical springs. The leading platform is located between two sets of vertical springs, one set being in tension and the other in compression and is a set of horizontal toggle springs. All sets of springs are preloaded in the datum position.

The author shows that by increasing values to the stiffness of each system of springs and to the initial deflection of each system in the datum position, the values of the overall stiffness obtained by differentiating the equation for displacement has a minimum value of zero termed anomaly, at the datum position, and a high stiffness against large displacements.

Different arrangements of the springs can be made which provide for applications where isolation from linear motions only is required and where uniformity in the vertical motion is required. These requirements are typical of gyroscopic measurements in missiles and aircraft.

## Underwater Ejection Tests

High speed sea trials of ejection seats up to 515 ft, simulated for the first time under water in a controlled rig with a live subject, have shown that ejection seat body motions are made complex. Measurements made by RAF Research Institute of Aviation Medicine, Farnborough, have revealed four vectors of 570 lb tending to lift and open the thighs and a 170 lb vector opening on the seat. These forces considerably exceed normal values.

Tests carried out by the doctors on themselves during high speed tests have also clarified the ejection mechanism. For ejection, the seat is, as previously believed, moved by displacement of the controls in their seats but is simply due to differential blast pressure effects. Blast pressure of 70 psi acting on the upper area of the chest causes the chest to pump blood into the head which causes the pressure and reduces the weaker blood vessels.

The maximum underwater speed achieved in the Admiralty underwater ejection tests at Farnborough was 30 kt, equivalent to a speed of 515 ft/sec level. Total body pressure experienced at this speed was 1,590 lb.

Calculations on the underwater and ejection conditions on the doctor's ejection system in this program.

The RAF Institute of Aviation Medicine is conducting a number of investigations on ejection seat applications. Classified top secret, high altitude research, the RAF Institute of Aviation Medicine includes work on a three-seat, side

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is safe, when assigned to an unspecified aircraft, which could have space value potential. The entire cockpit mockup is currently on the large testbed at Farnborough.

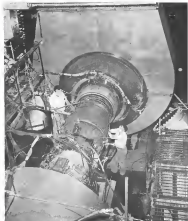
Controlled experiments believed to involve very high altitude effects, among the same sections of the Victor bomber, also are being conducted.

The institute has devised a number of techniques to simulate an unstable zero g condition. Experiments have been carried out with life shafts and accelerators, mostly to measure land-crew coordination in the weightless condition. The principal technique developed differs from that used for similar experiments in the U. S., as official told AVIATION WEEK, is that the subject does not view a target object directly, but through an optically projected image of the same size. The "agent" of the remote control loop and presents the subject from encountering the movement of the hand toward the object.

A novel method of determining peripheral vascular reactions in the weightless condition has also been developed, in which the subject was placed in the Farnborough centrifuge aligned longitudinally with the centrifugal acceleration, first with his head outward for a series of positive g loadings up to 4g, and then with his head inward for a number series of negative g loadings.

The effects of zero g which cannot be simulated in the centrifuge were found by extrapolation to be roughly on a straight line passing through the positive and negative values.

A new method is also planned by medical scientists at Farnborough to measure cardiac output changes under positive g loading on the centrifuge. Access to the heart was gained by a catheter inserted through a vein in the arm and passing into the right ventricle. Cardiac output was derived from the change in oxygen content of the blood sampled from the catheter.



**J57 Tested as Stationary Power Unit**

Stationary power unit, using Pratt & Whitney J57 turbojet engine, is tested for a test run at P&W's Wilcox test facility at East Hartford, Conn. Engine supplies power to a turbine developed by United Research Corp. Mt. Vernon, Ohio, and will later install gas in it passes get through turbineless face of Edwards Gulf Turbineless Co.



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- Climb to 5,000 meters (16,403 feet):**  
Current record: 1:39.6 minutes—held by French Alouette  
PB-1 record claim: 3:22.4 minutes
- Climb to 5,000 meters (16,403 feet):**  
Current record: 1:11.0 minutes—held by French Alouette  
PB-1 record claim: 3:10.2 minutes
- Maximum Climb, Closed Circuit:**  
Current record: 275.1 miles—held by Russian Mi-4  
PB-1 record claim: 401.24 miles
- Speed Run, 3 kilometers (1.94 miles):**  
Current record: none  
PB-1 record claim: 150.85 mph
- Speed Run, 100 kilometers (62.14 miles):**  
Current record: 130.8 mph—held by Russian Mi-4  
PB-1 record claim: 142.2 mph
- Speed Run, 500 kilometers (311.45 miles):**  
Current record: 158.02 mph—held by Sikorsky  
HU-1 record claim: 148.45 mph
- Speed Run, 500 kilometers (311.45 miles):**  
Current record: 152.07 mph—held by Russian Mi-4  
HU-1 record claim: 148.45 mph

\*Tests were run during night cross-country tests in July, 1969 under the supervision of the National Aeronautics Association. Certification is pending from N.A.A. and Fédération Aéronautique Internationale.

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## FINANCIAL

### BOAC Deficit Rises; BEA Reports Profit

British Overseas Airways Corp. reported improved operating results in its 1979-80 fiscal year, but its overall net loss continued a trend that has in caused its accumulated deficit from \$8.5 million to \$62.6 million in three years.

This is in contrast to British European Airways, which reported a \$5.5 million profit in the same fiscal year and the Comair-owned carrier, Gatwick, which reported a \$2.4 million profit for the year 1979 and Trans Canada Air Lines, a \$132.44 net profit.

Compassionate with other Commonwealth airlines, or with U.S. interests based airlines are hard to draw because of differences in accounting practices and terminology and because of the nebulous function of British Overseas Airways Corp. as an instrument of national policy, either once and for all or diplomatically.

#### Problem Areas

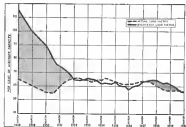
But some might not be guard rails to the special problem areas of BOAC by comparing remuneration of its 1979-80 profit and loss statement with BEA's.

BOAC	BEA
Operating Profit	\$12,841,684
Interest on government-owned shares or analogous grants	\$16,251,163
Interest capitalized	\$2,861,282
Interest receivable	\$2,415,143
Subsidized companies profits or losses and related adjustments	\$5,112,925
Profit (losses) for year	\$3,334,630

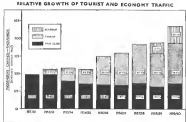
BEA, after adjustments, and approximating \$1.4 million to its insurance reserve and \$2.6 million to a development reserve, was able to carry a net balance of \$325,490 to the next year. After five-month adjustments from prior years, BOAC showed a \$1,388,625 net loss in its accumulated deficit, to total \$42,465,843.

The reason why BEA can lay wide funds for reserves and show a small net profit while BOAC continues to accumulate deficits appear to be due to this comparison in the heavy debt structure of BOAC and its losses on subsidiary and associated company operations.

BOAC subsidiaries incur the present paying out company's for their losses.



BRITISH OVERSEAS AIRWAYS charts show (top) trend in actual and BEA's losses had for last year 1980 and changes in losses of other airlines.



Middle East Airlines, for example, paying BOAC with freight traffic worth \$4.2 million annually and points out it has bought \$15 million worth of British assets and has \$17 million in Comair 4C orders.

BOAC's total borrowings are almost three times those of BEA. They look down into BOAC stock amounting to \$160 million and bearing interest rates of 11 to 14%. BEA's comparable stock amounts to \$44 million at 7 and 11% interest.

• End-user advances which total \$300 million and carry interest rates from 11% to 14%. BEA's advances from the owner of aviation total \$90 million.

• Bank loans including a U.S. dollar loan of \$21 million. BEA does not have its short term bank credit as part of its capitalization, but shows \$150,000 in bank credit in its current liabilities. For BOAC, this is a total capital commitment of \$301 million, compared with \$119 million for BEA. Flight equipment and property, including 70

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BRITISH EUROPEAN AIRWAYS charts depict load factor trends and surprising spread between revenues and expenses.

revenue with a load-depreciated value of \$70 million and progress towards the annual order accumulation of \$40 million are the major source of explanation of BEA's capital.

#### Fleet Costs

BOAC's statement of capital employed includes \$176 million load-depreciated value for its fleet of 62 aircraft, \$65 million for progress payments and \$14 million in arrears in its associated and scheduled companies as major items. Breaking total order-placed fleet costs by the number of aircraft:

• BOAC average aircraft cost figure at \$15 million for its fleet of predominantly large, longer range aircraft—British Britannias 102 and 512, de Havilland Comets 4s and Douglas DC-7s.

• BEA average aircraft cost of \$172,000 for its predominantly Vickers Viscount fleet.

Even this is not an exact comparison as fleet costs since BOAC wrote off \$14 million in Comet and Britannia direct contract costs in its 1958-59 fiscal year against its capital account, indicating this figure is not reflected in its balance sheet book value figure for its total fleet cost.

BOAC had not begun to take delivery of its 15 Boeing 707-120s which will add at least \$70 million to BOAC's fleet value this year and then cost is not reflected in the accounts. BOAC also has 15 Vickers VC 10s on order under contracts totaling \$150 million due for delivery starting in 1967.

#### New Aircraft

BEA also has large commitments for new aircraft—\$221 million for 28 first class Avoncraft Corp. D81121s and \$47 million for 20 Vickers Vanguard, due in service later this year after a delay due to engine modifications.

Running power of both companies were used this year, BEA's load to \$266 million and BOAC's to \$384 million. BOAC, which paid interest on bank charges of \$36 million last year

compared with \$5 million for BEA, with a substantial accumulated deficit and with a fleet proportionately less depreciated than BEA took a significantly different tack than BEA had taken in the face of its continuing on its own figures.

BEA issued barely apologetic at its net profit and indicated its awareness of its annual obligations as a national commitment to being on level with the public at large cost.

BOAC on the other hand said little about annual obligations and took care to point out that in the eight years since its formation period it has had to pay fixed interest charges of \$44 million to the government. To do

so, it had to borrow an additional \$38 million from the same source on which it had had to pay still further interest charges.

Because of the delay in delivery of the 707s for modifications to the tail, BOAC said it had to borrow some \$11 million during the year. But substantial amounts will be needed some \$20 million in the next three years and an additional \$16 million in 1963-64 when VC-10 deliveries begin. Redesigns and improvements should affect aviation in total debt but it is plain that BOAC will be approaching its situation fairly soon though it feels the new ceiling will be adequate for its needs.

BOAC did note that it was grieved

### PROBLEMATICAL RECREATIONS 35



Each face of a regular dodecahedron is painted with a different color. Using the same 12 colors, how many dodecahedrons with different color arrangements are possible? —Mathematics Magazine

To the National Divergence Conference in Chicago, and to the distinguished sponsors, we wish a colorful meeting.

LAST WEEK'S PROBLEM: The mother was 5 when her child was born, which makes the brains 37½ inches long 32 years later.

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that the Select Committee on Nationalized Industries pointed out that too much of the cost of developing new British aircraft appears to fall on BOAC and BEA, placing them at a disadvantage with competition using American aircraft. Various accounts to provide additional support to the American position at the same time will be partly deflected if the manufacturers are so forced to include in the price charged for their aircraft a levy to reimburse the government. BOAC added in a confidential source.

A specific account expressed by BOAC was on the status of its 10 DC-7Cs, ordered as six interim aircraft until its long-range Britannia 312s became available, an agreement that they would then be converted. These aircraft are carried at a book value of \$16.5 million to \$1.6 million per aircraft.

Some of these aircraft are in open market now might be a successful one. BOAC said and will not be, but have been in the accounts to absorb such a loss. Some, or all, of this loss might be avoided if BOAC was permitted to continue to use the airplanes, especially on long range contract operations.

BOAC apparently has to follow a few provisions of the provisions of the other International Air Transport Association. An informal source made by a U.S. carrier showed most LATA cases, followed a 10-year 1950 schedule value schedule for jet aircraft. BOAC spoke in terms of a 25-year, 25% residual value schedule. For a 54-month airplane that would mean higher annual depreciation charges but a smaller total charge at the end of the depreciation period.

#### Comet Write-Off

Actual practice may vary from this procedure, however BEA for example, is depreciating its five Comet 4B aircraft at the rate of one-eighth of net per year, though BEA did not indicate whether these figures are net but be written down to zero residual value.

In a corporate memorandum of its basic conservative objectives BOAC said that it is pursuing an expansionist policy that has increased its capacity ten miles from 251,004,561 in 1956-57 with a corresponding average load factor of 63.1 to 418,152,504 in 1959-60 with an average load factor of 57.6. The yields of its policy to the profit and loss account must be justified by the long term prospects. BOAC said.

One area BOAC is investing in carrying out this objective is the reduction of maintenance costs as a contribution to cutting break even load hours which stood at 55% this year, compared with 57% five years previously. BOAC recorded its maintenance provisioned be 1,251 during the year, cutting its maintenance department costs 1.6 cents a

cent per ton mile the report said. BOAC's total personnel rose slightly, however.

BOAC's maintenance costs rose 34% of its 1958-59 expenses totaling \$554 million, or 21% of its \$196 million in-

crease. BEA spent on maintenance 35% of its 1958-59 expenses of \$91 million or 18% of its means of \$102 million. Though some other methods may not present a valid comparison. For American flight 15% of its 1959

## Fiscal 1960 Defense Funds

Annual procurement and research obligations and expenditures details for Fiscal 1960 have been released by Department of Defense. Obligations are indicative of new contracting, expenditures, of the actual level of production or research effort sustained throughout the year. Congressionally approved funds are in specified amounts of changes in budget allocations—usually the shift of funds, previously budgeted under "procurement" to the development, test, and evaluation category.

### Procurement

	Obligations (Thousands of Dollars)	Expenditures (Thousands of Dollars)
	Unobligated Balance	Unpaid
FY 1959	June 30, 1959	FY 1959 June 30, 1959
<b>Army</b>		
Aluminum	322,795	137,006
Steel	646,124	115,415
Unsubstantiated and Communications	519,199	264,609
<b>Navy</b>		
Aluminum	1,099,184	1,058,599
Steel	498,236	188,247
Unsubstantiated and Communications	815,944	555,819
<b>Air Force</b>		
Aluminum	3,584,665	3,470,339
Steel	3,429,173	489,491
Unsubstantiated and Communications	794,655	331,054
<b>Department of Defense Total:</b>		
Aluminum	5,447,362	2,916,438
Steel	3,935,454	787,249
Unsubstantiated and Communications	5,218,627	484,243

### Research, Development, Test and Evaluation

	Obligations		Expenditures	
	(Thousands of Dollars)		(Thousands of Dollars)	
	Unobligated Balance		Unpaid	
	FY 1959	June 30, 1959	FY 1959	June 30, 1959
<b>Air</b>				
Military Research	164,869	91,789	121,279	91,940
Aluminum	31,622	18,862	18,319	54,498
Steel	486,365	42,942	173,594	21,184
<b>Naval</b>				
Military Research	109,148	3,562	122,560	87,379
Aluminum	86,558	15,317	79,114	71,120
Steel	660,799	13,414	204,208	246,871
Aeronautics	—	3,840	—	—
<b>Air Force</b>				
Military Research	545,122	35,149	167,257	167,744
Aluminum	375,563	36,876	153,782	132,618
Steel	129,184	12,614	144,440	161,250
Aeronautics	391,597	5,719	179,144	121,260
<b>Office, Secretary of Defense</b>				
Military Research	34,808	7,344	31,408	34,711
Aluminum	46,788	27,213	25,113	76,818
Steel	391,550	13,840	291,145	45,618
<b>Department of Defense, Total</b>				
Military Research	765,221	41,381	347,978	381,793
Aluminum	587,143	20,960	204,151	312,071
Steel	1,217,223	64,764	762,551	732,744
Aeronautics	489,719	41,534	400,113	268,153

total expenses of \$399 million on materials and TCA 20% of its \$120 million (Canadian dollar) expenses. Besides its heavy material charges, BOAC has one other major area of contact with BEA in its subsidiary and associated company operations. The results in 1959-60:

•BOAC share of losses for subsidiary companies British West Indian Airways: \$1,728,000, Hong Kong Airways, representing several loss on sale of the company during the year to Cathay Pacific Airways: \$771,000, Midland Airways Co.: \$107,000.

•Losses on associated companies: Bahamas Airways and Saronis Airways, \$49,000.

•Losses on Kuwait Airways operations contractedly undertaken, \$670,000.

•Profits on subsidiaries: Adair Airways, \$168,000, Gulf American Co., \$65,800.

•Profits share of associated companies: Arab Airways Inc. liquidated, Glens Airways, Malayan Airways and Middle East Airlines: \$189,000. (The \$189,000 was profit of Middle East Airlines was a net loss of \$189,000 over the prior year when this carrier lost \$4.5 million.)

After adjustments the deficit for the year its subsidiary operations reported by BOAC totaled \$1.3 million.

BEA does not have as great an interest in its subsidiary and associated companies, but it reported receipt of \$20,000 in dividends from its various profit making investments including Arab Turakul, Ltd., which operates terminals in London, Air Lines of Iran, Africa of Italy, Comoros Airways, Ltd., Cyprus Airways and Malta Airways.

## Caravelle Paces

### French Exports

Paris—Staged up deliveries of Sud Aviation's Caravelle jet transport during the first half of 1960 have pulled the industry's aircraft export figure to \$161 million, more than twice the export order delivered in one previous 12-month period.

French industry, in fact, claims that its current export performance, if current figures are added to number of aircraft industry exports, is higher than either the U.S. or Great Britain. French aircraft exports, about half of which are accounted for by Caravelle sales, are expected to reach \$300 million by the year-end. Last year, the high export rate results may be due to continued Caravelle deliveries.

In addition to the Caravelle, the next largest item on the industry's export list is made up by orders. Some \$25 million worth of orders, mostly Nord Aviation \$8-10 and \$8-14 aircraft, was received during the first half of this year.



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## Okanagan, Bristol Merger Collapses

Vancouver-Proposed \$4 million merger of Okanagan Helicopters, Ltd., and Bristol Aeroplane has been cancelled and Bristol President R. J. Baynolds has resigned. His resignation was attributed to differences of opinion between himself and Bristol's board of directors. W. S. Haggart formerly a vice president of Bristol, succeeded Baynolds as president of Bristol.

Under terms of the proposed merger (AW Jan. 20 p. 174), Bristol was to acquire all outstanding shares of Okanagan at \$4.50 per share and to enlarge the company to the purchase of Sparrow Air Services of Winnipeg and Avco Helicopters of Montreal. It is understood that Bristol was unable to finance the deal.

## New Offerings

**Kofmeier Corp.** (Northampton, Mass.) principal products include submersible, gas engine and other optical equipment, laser, acoustic and ultrasonic-mechanical equipment and electronic apparatus. Offering in \$6170 shares of common stock, \$5.800 shares to be offered for public sale for the account of the company, and \$1.170 remaining shares in the present holding thereof. Public offering price and underwriting terms to be supplied by arrangement. Proceeds from the stock sale, together with the proceeds from the private sale of \$710,000 in principal amount of long term notes and general funds available generally from retained earnings, will be used to reduce all of the company's outstanding shares of 70 convertible preferred stock at an aggregate redemption price of \$41,500 plus accrued dividends to repay the proceeds outstanding first mortgage note in the amount principal amount of \$345,500 plus all interest and all costs related to reduce the outstanding short term bank loan proceeds aggregating \$600,000 to purchase approximately 100,000 of new machines and equipment for the production of tape readers. To pay a government grant of \$65,000 balance for working capital and other corporate purposes.

**The Perle-Eliot Corp.** (New York, Conn.) engaged in the design, manufacture and sale of precision scientific instruments which analyze chemical compounds to measurement of their distinct physical characteristics and electromagnetic waves and produce optical spectrographs for space and marine fields. Offering in 100,000 shares of common stock for public sale, offering price and underwriting terms to be supplied by arrangement. Of the pro-

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## Improved Interference Filter Capacitors Have Excellent Environmental and Insertion Loss Characteristics



Recent technical data released by the Sprague Electric Company, North Adams, Massachusetts, reveals the unusual environmental and retention loss characteristics of the company's subminiature "Thin-Film" Filter Capacitors. The performance of these capacitors is said to exceed closer to that of a theoretically ideal capacitor than any other type of capacitor ever made.

When properly installed, these capacitors reduce to a negligible value the effects of external cross coupling. They also provide a minimum length of path to ground for radio interference currents. Thin-Film Capacitors are designed to meet all the electrical, mechanical, and environmental requirements of Military Specification MIL-C-12093.

Both Type 102P and Type 102S are impregnated with Vitreous Q, Sprague's exclusive inert synthetic impregnant, in order to achieve maximum insulative resistance and maximum capacitance change with temperature. Type 102P units are processed for  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  operation, Type 102S for  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  Maximum load-thru current for which both are rated is 5 amperes dc continuous or equivalent.

For complete data on Thin-Film Capacitors, write for Engineering Bulletin 5015 to Technical Literature Section, Sprague Electric Company, 327 Marshall Street, North Adams, Massachusetts.



## NEW WET-ANODE TANTALEX<sup>®</sup> CAPACITORS

for 125 C operation

Another Sprague "first" for military and industrial designers—Type 135D Wet Electrolytic Tantalum Wetted-Anode Tantalex Capacitors for 125 C operation without voltage derating.

The remarkable electrical stability of these capacitors is the result of special aging, the use of inert materials, and a low dielectric loss. Construction is designed to meet the 2600-cycle military missile vibration requirement. Shelf life is excellent.

Shoulder-less shape makes mounting in printed wiring boards easier, even punching slots in boards or the use of "chains", and simplifies board wiring layout.

For complete technical data, write for Bulletin 5703 to Technical Literature Section, Sprague Electric Co., 12<sup>th</sup> Marshall St., North Adams, Massachusetts.

# SPRAGUE

THE MARK OF RELIABILITY

each \$1,000,000 will be applied to construction of a plant in Nanvick, \$500,000 to the purchase of machines and equipment, the remainder added to the general funds.

The Helioheaters Co., Chicago, Ill., engaged in research development and manufacture for the military, of electronic equipment such as missile countermeasures, electronic countermeasures, capacitors, fixed station transmitters, gun equipment and airborne radar jamming equipment. Offering is 500,000 shares of capital stock, 100,000 shares for public sale for the account of the company, and 200,000 retarding shares for the private holder. Offering price, and underwriting terms to be supplied by investment. Proceeds of the 100,000 shares will be used to convert, in the company's working capital, \$1,000,000 of which will be used to liquidate the other shareholders' bank loans. In the new future, \$500,000 of the company's funds will be used to purchase machinery and equipment and purchase time facilities for new plant facilities in Chicago and \$250,000 for expenses of research development, office, and administrative facilities and purchase of laboratory equipment for the existing plant.

Vitronics, Inc., Bridgeport, Conn., engaged in the manufacture and sale of solid state electronic electronic products and semiconductor materials. Offering is 500,000 shares of common stock, 101,012 shares of common stock, 25,000 shares for public sale in the company, and 77,987 retarding shares in the present holder. Offering of the proceeds of the 25,000 shares \$25,000 will be used to reduce the outstanding indebtedness of \$112,500 to pay the balance of working capital.

Alko Electronic Corp., Miami, Fla., engaged in the business of designing, developing, manufacturing and selling to integrated line of electronic equipments and systems for use in various, inside and outside, integrated offering is 65,000 shares of common stock, to be offered for subscription to holders of outstanding common stock, at the ratio of one new share for each six shares held. Record date subscription price, and underwriting terms to be supplied by underwriter. Of the proceeds, \$636,500 will be used for the payment of short-term bank loans, \$100,000 for the expansion of the volume of sales in process and of machines of. \$100,000 for \$125,000 for development of custom components for use with presently carrying general purpose analog computer, the balance for working capital.



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## BENDIX SYSTEMS DIVISION

ANN ARBOR, MICHIGAN

## WHO'S WHERE

(Continued from page 27)

### Honors and Elections

Dr. C. Stark Draper, head of the Draper Corp. of Aeronautical and Astronautical Engineering and Director of the Instrumentation Laboratory at Massachusetts Institute of Technology, has been named member of The Franklin Institute's Board of Fifth Medal for his "technical and applied contributions to the science of celestial navigation, which have resulted in extending accuracy in the accuracy of navigation and in the surface of the ocean through the air and into space."

R. V. Huggan, Washington, D.C., Corp., vice president and chairman of the defense committee, has been elected president of the National Security Industrial Association for the coming year.

Dr. William S. Kettering, superintendent of the Weather Service, Toronto (Headquarters, Meteorological Service, Canada, Department of Transport), has been elected a first year honor of doctor in civil science, Technical Office (Executive Assistant) to the Secretary General of the World Meteorological Organization, Geneva, Switzerland, and as chief of the Administrative Division of the Secretariat.

### Changes

Col. Charles E. Dring, deputy commander, Pacific Marine Corps Headquarters, Ft. Meade, Md.

Dr. Robert E. Wilson, associate technical director for aerodynamics, U. S. Naval Civil Service Administration, New York, N.Y.

Col. Henry E. Gable, director of operations, Air Force Materiel Command, Air Force Materiel Command, Washington, D.C.

Major A. F. Fiedler, chief systems advisor, Bendix Systems Division, Bendix, N.Y.

Dr. J. A. Mendenhall, director of engineering, Aerospace Technology, Bendix Systems Division, Bendix, N.Y.

Dr. Paul H. Butler, Jr., senior Design Director, Bendix Systems Division, Bendix, N.Y.

Major J. Mendenhall, manager of equipment support, General Electric Co. Aircraft Systems Division, General Electric Co., Pittsfield, Mass.

Major A. F. Fiedler, chief systems advisor, Bendix Systems Division, Bendix, N.Y.

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Typical building block units are illustrated. Temperature range is -55°C to +125°C. Basic units can be modified.

## GENERAL ENVIRONMENTAL CONDITIONS

- A. Temperature—-55°C to +125°C
- B. Altitude—-1000 feet to 40,000 feet
- C. Humidity—Between 44.3 of MIL-8-8012
- D. Vibration—0.25 inch double acceleration from 5 to 18 cycles per second and 0.2 g acceleration from 10 to 500 cycles (without vibration testbed)
- E. Crash Safety—Repeated shocks of 30 g with duration of 11 milliseconds
- F. Salt Atmosphere—Section 4.6.1 of MIL-8-8012
- G. Fungus Growth—Section 4.6.1 of MIL-8-8012
- H. Sand and Dust—Section 4.11.1 of MIL-8-8012

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**TYPE MIL-S-SYNCHRONIZER**  
Slew 41,000 to 64,000. Control Transducer Speed 0.10 degrees/sec to 0.10

### TYPE MIL-S-SYNCHRONIZER

Motor Control Phase—400 to 1000 rpm, 110 volt, 50/60 cycles  
Motor Reference Phase—315 volts, 22 amp, 400 cycles  
Control Phase—315 volts, 22 amp, 400 cycles  
Slew Rate—0.10 to 0.10 degrees/sec

Available Output—1000 rpm, 110 volt, 50/60 cycles  
Control Transducer Speed—0.10 degrees/sec to 0.10  
Motor Control Phase—400 to 1000 rpm, 110 volt, 50/60 cycles  
Motor Reference Phase—315 volts, 22 amp, 400 cycles  
Control Phase—315 volts, 22 amp, 400 cycles  
Slew Rate—0.10 to 0.10 degrees/sec

### TYPE MIL-S-SYNCHRONIZER AMPLIFIER

Input Impedance—100 ohms to 1000 ohms  
Output Impedance—200 ohms to 1000 ohms  
Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

### TYPE MIL-S-SYNCHRONIZER AMPLIFIER

Input Impedance—100 ohms to 1000 ohms  
Output Impedance—200 ohms to 1000 ohms  
Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

### TYPE MIL-S-CHANNEL ISOLATION AMPLIFIER

Input Impedance—100 ohms to 1000 ohms  
Output Impedance—200 ohms to 1000 ohms  
Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

### TYPE MIL-S-SERVO ACTUATOR AMPLIFIER

Input Impedance—100 ohms to 1000 ohms  
Output Impedance—200 ohms to 1000 ohms  
Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

### TYPE MIL-S-RELAY AMPLIFIER

Input Impedance—100 ohms to 1000 ohms  
Output Impedance—200 ohms to 1000 ohms  
Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

### TYPE MIL-S-REVERSE AMPLIFIER (DUAL)

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Voltage Gain—100 to 1000  
Supply Voltage—120 volts, 50/60 cycles

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# BUSINESS FLYING



**EXECUTIVE AIRPORT** being developed by Spher, Inc. (see P. 10). Work, Tex., will have low-cost office-terminal building (right) and a new hotel (left). The new airport will provide larger space and facilities for 240 aircraft.

## Executive Airport Planned for Ft. Worth

By Kevin J. Dalton

Ft. Worth, Tex.—First step toward construction of an \$5 million executive airport, which is planned for housing 240 aircraft, will have been with signing of a contract between Spher, Inc. and Owen Steel Building Co. for erection of 20 prefabricated buildings.

Construction of the new 630-acre airport designed exclusively for business and private aircraft will begin early in 1967, according to a spokesman for Spher, Inc., which is developing the project.

Final completion is scheduled for March 1967.

Facilities will include a 5,000-ft. x 100-ft. terminal building, a 175,000-sq.-ft. hangar and control tower. The airport will be located some 3 mi. south of Ft. Worth adjacent to a 25,000-acre industrial development.

### Lease-Purchase

Financing of the project will be a lease-purchase proposition. A syndicate of New York real estate interests is purchasing the land, buildings and other facilities and leasing these back to Spher, Inc., a Texas corporation owned by a group of Ft. Worth Dallas businessmen and Dallas businessmen and industrial executives. Spher, Inc., is now sitting at a "dead-end" will lease facilities to build bus, operator, retaining control over fuel transactions, although the operator will pump gas at each of their individual facilities.

The lease-purchase of facilities is believed to be new in the airport field, although it has been recurring in volume in other aspects of the transportation industry because of the objective factors it offers in reducing capital expenditures and its benefits.

Growth potential of the area is cited by Spher, Inc., executives as the reason for their optimism in the project's success. Not only is the new field site

located in a strategic area which is undergoing industrial development, but so many of corporate aircraft activities in the state also point toward a good future. At nearby Meacham Field, for example, a survey shows that plane movements there are expected to reach some 192,000 in 1970 compared with approximately 155,000 now and that the number of aircraft based there will grow in about 420, more than double the current figure.

Spher, Inc., also is studying future development of its operation beyond the airport. Indications are that plans include development of a hotel and related business facilities and entering the business aircraft design and production field. The latter is seen as occurring in the next five years.

### Safety Awards

Los Angeles-National Business Aircraft Assn. honored 217 top business pilots for flying a total of 214,186,112 mi. without crashing their aircraft or requiring passengers to leave.

Awarded safety certificates during NBBAA's 19th annual meeting and dinner were 96 pilots who have flown 1 million or more miles without a single injury and 123 pilots who have flown 100,000 or more miles.

In addition, 38 of the leading U.S. business and industrial firms were cited for their perfect business aviation safety records. Among those 1 million or more miles without accident. One company, Goodwin Ties & Builders Co., Akron, Ohio, has logged more than 5 million mi., four firms have recorded at least 1 million mi. each, but have flown more than 4 million mi. each, 12 have flown more than 3 million mi. each and 14 were recognized for having completed more than 2 million mi. each in their executive aircraft.

### Hangar Facilities

Hangar facilities to be built include three buildings, each composed of six complete hangars, 190 ft. x 122 ft., with a clear opening of 120 ft. and a 30-ft. clearance. Sleep and office space will separate each hangar to provide an individual operating space. Over all length of each building will be 1,800 ft.

In addition, 24 74-passenger jets will be stored, one group having a clear opening of 40 ft. x 12 ft. x 12 ft., the other of 54 ft. x 36 ft. x 40 ft. The smaller jets will house aircraft from Cessna 310s down, the larger will handle planes in the Twin Otter and Aero Commander class. A Tulsa Steel agent noted that the 32 hangar contract signed with Spher is the largest of its kind

## THERE IS NO CEILING ON IDEAS



Advanced hydrogen systems being developed by The Garrett Corporation solve the problem of keeping men alive and equipment operating for long periods of time in future satellites and space capsules.

Engineers at The Garrett Corporation's A/R Research Manufacturing Division are dealing with challenging problems in life-support fields.

Diversification of effort and rigorous leadership have made Garrett the world's largest manufacturer of aircraft components and systems and a leader in specialized marine and spacecraft systems.

### Major fields of interest are:

- **Environmental Control Systems**—Passive, heating, dehumidifier and supplies of air conditioning and pressurization systems for commercial and military aircraft, and life support systems for satellites and space vehicles.
- **Aircraft Engine and Electronic Systems**—Largest supplier of aircraft engine fuel data systems, also working with other electronic controls and instruments including marine and submarine applications.
- **Marine Systems**—Largest supplier of auxiliary power units. Aftermarket is also working with hydraulic, hot gas and hydrogen systems for auxiliary liquid and gas storage valves and controls for ground support.
- **Gas Turbine Engines**—World's largest producer of small gas turbine engines, with more than 9000 delivered in the 30-500 hp class. Studies include industrial and nuclear applications.

Excellent positions are available for qualified men with M.S., Ph.D. and B.S. degrees for work in these areas.

Send resume to: Mr. T. E. Watson  
**THE GARRETT CORPORATION**  
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 Los Angeles 45, California • Phoenix, Arizona

handed by his company. Those in Ft. Worth branched dealer for Intrepid Steel Products Co.

It is expected that the airport will be operational by Oct. 31, 1963, with the terminal and control buildings to be in by the scheduled opening. Construction data for the following year: Sphere Inc., currently negotiating lease agreements with tenants for the terminal and will lease the terminal to a national chain operation. Selection of an airport manager is also under consideration.

Operations is planned on a 24-hr. basis, with complete servicing, sales and storage facilities. Terminal building will include a private club, business center, retail and restaurant seating 175. Officers of Sphere, Inc., include Raymond H. Berry, president; Paulton C. Christ, board chairman and vice president; Ken R. Berry, executive vice president; Stephen F. Hallford, secretary; Richard J. Maningers, vice president; and D. T. Dai, treasurer.

Architect engineers on the project are Harkender, Clark and Jones, Ft. Worth; Francisco are being handled through Owen W. Stewart, Georgetown, Tex., and Nabors Whitland, N. Y. C.

## Interior Modified In New Comanche Models

Last month, Pi-Intérieur refinements mark the new 1961 models of the four-seat Comanche business plane on which Piper Aircraft Corp. is starting deliveries to deliver this month.

Important changes over last year's model include revised instrument panel layout, substitution of a fluorescent autopilot and automatic radio direction finder for hush to supplement the hand built-in standard equipment instrument panel and improved cabin heating and ventilation.

The Comanche 230 also is available with a 90-gal. fuel capacity, an increase of 30 gal. over previous models, providing more than 6 hr. range at 151 mph maximum cruise speed in 12 hr. range at 157 mph economy cruise speed. Gross weight for the 243 hp version also is up 300 lb., providing a permissible payload of 1,270 lb.

New model's instrument panel layout is similar to that used on the light over Apache. Basic instruments are located on the left side, in front of the pilot. Engine gauges are relocated to the extreme right and radio equipment is centered for optimum access. Other front seat occupant: A control console for cabin air flow and temperature also is located on the panel.

Piper offers the revised autocoupled switch in standard equipment on the Comanche, but this year is providing an optional equipment, a three-dial-

round all-transmission autopilot system, including pitch control, control yoke, heading lock, altitude passout slide and altitude hold. This new equipment costs \$1,245 additional.

Standard on the 1961 Comanche are two fuel tanks on the left side, supplementing the hand built-in. Safety valve gas vents either level, either from being trapped in flight.

The 1961 line is offered, in total, in four models—Standard, Cavalier, Super Cavalier and Aerostar. Standard version includes three instruments and lights. Cavalier model includes a standard gyro panel and radio in optional package consisting of a 13 channel Navaid Super receiver for VHF communications, full wave navigation and the Piper Autopilot LP BDC direction finder. Super Cas-

low replaces the Superpower with a Navaid Mk. V, 30-channel transceiver (100-channel crystal-controlled receiver for VHF communications, coupled with Navaid VOA Mk. II voice receiver and CS-1 VOR) ILS navigation indicator. The Aerostar version has all of the Super Cavalier's equipment, plus the Piper Autopilot autopilot.

## Southwest Airmotive Shows 40% Sales Gain

Dallas, Tex.—Southwest Airmotive's 40% for the fiscal year ended May 31 over the similar fiscal period last year is reported by Southwest Airmotive Corp., a major business aircraft broker, dealer, lessor. Total sales for the year



## Private Viscount Modified

Private Viscount modified as shown after modifications by The Garrett Corp.'s A/R Research Manufacturing Division, Los Angeles. The four-engine turboprop, modified to accommodate 12 passengers and a crew of five is equipped with rotating wheel seats with retractable leg rests, sleeping berths, additional lavatory and new forward galley.



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the pilot to confirm that he had the field in sight. He replied: "Roger, have you field in sight?"

At 1711 the pilot reported the loss of Glade Mountain and McGeeh reported approximately 9,100 ft and requested the pilot had a third alt. reported. Yes—what is the altitude? McGeeh gave the altitude as 19,04 after which the pilot replied "Yes, I read some altitude. I missed the last step the altimeter was on 19,70."

At 2214 McGrath, using information obtained from Tiziane, advised Fucci that his boarding to McGrath was 100 days, and that he was now 20 mi from the airport. McGrath then asked for his personal effects, to which the pilot replied, "A \$3000 fr., in the bag, but I am really out of. Father will have a bag with some clothes."

This was the last radio contact between McCaughy and the Boych, and at the time Tatham lost radio contact with the aircraft. McCaughy attempted repeatedly to re-establish contact without success.

[illegible]

Identify the following:

to the aircraft had not been refused at either Korye or Tsimna, the entire flight from Korye to the accident site had been made on 200 gal of fuel. The total flight time from Korye to Tsimna to the accident site was 5 hr 50 min.

Investigators defended the following data for the northern populations. Between 1950 and 1960, during the period from 1950 to 1960, there were 100,000 to 150,000 sheep from level at 3,000 to 4,000 ft above sea level along the entire state. There were also perhaps 100,000 to 150,000 sheep from level at 1,000 ft. As a result, the total of 100,000 to 150,000 sheep was estimated to be 100,000 to 150,000 sheep or double. The sum of the sheep from level at 10,000 ft above sea level was 100,000 to 150,000 sheep, and the sum of the sheep from level at 1,000 ft above sea level was 100,000 to 150,000 sheep. The National level was at 1,000 ft above sea level was 100,000 to 150,000 sheep, and the sum of the sheep from level at 1,000 ft above sea level was 100,000 to 150,000 sheep.

Surface winds along the route were mostly at less than 5 kt, becoming southwesterly 10 to 15 kt at 3,000 ft and southeasterly 12 to 15 kt between 5,000 and 10,000 ft above mean sea level. Over the surface, a thick cloud deck contained light snow would have been experienced in the clouds above the freezing level to 10,000 ft. Visibility above was unlikely except for possible light turbulence near Tampa. Over the mountains of the state and on the McGowan area high

A very light rain begins to fall at McGrath.

at 2180 and approximately 15 min before the accident the observations at McGrath gas station yielded a reading of 4,000 ft. overcast visibility. 20 min prior very light rain. Cloud heights at the U. S. Weather observation station at McGrath are measured by means of a Sodar laser instrument.

Pilot Price had more than 100 hr experience flying the model aircraft and had approximately 6,500 hr of total pilot time, much of it over the Ohio wilderness. He held a commercial pilot certificate, with multi-engine land and sea ratings. His last ground examination was passed in June 1999 at which time he had a total of 6,500 hr. He did not have an instrument rating.

### Aircraft Status

The last 100 ft had gradual impacts on the aircraft as on May 25, 1959, at which time the aircraft was notified as heavily hit. No further maintenance actions were made on the tailboom. However, the aircraft was "checked out" for use on the aircraft through April 20, 1959, and on that date 10 ft had been flown since the previous maintenance. DOL is superior. The preliminary test disclosed that the aircraft had made several flights since that date for which no action had been made. Although involved at accident, there was testimony by the survey conducted at Keesler of signs of considerable fatigue. There had been no fatigue of not were added at Keesler.



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to bring the oil supply to the proper quantity of 16 gal. The aircraft was equipped with VOR, VHF, ILS, LF/MF, and medium beacon systems and a VHF transmitter.

### Analysis

It is impossible to enter this accident directly to the mechanical causes, as during high air temperatures of the aircraft. The aircraft was obviously overflight again because from Karlsruhe. However, the aircraft was under its maximum gross weight of 7,500 lb by about 450 lb at the time it crashed because as it was not completely as very much out of fuel.

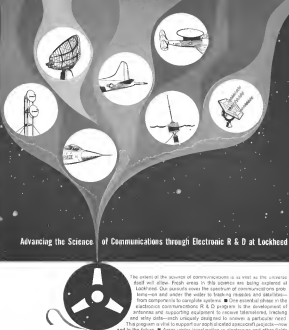
The series of events culminating in the crash of the aircraft cannot be definitely established. Apparently the last three fourths of an hour of flight was in dark, overcast, and unilluminated regions completely without lights and under no ground. There was no ADF in the aircraft as it had been removed for repair and Pratt was therefore forced to rely on the low frequency radio signals. Under these conditions navigation would have had to be by dead reckoning as by reference to low frequency signals. Pratt had worked 21 hr of duty upon leaving Tucson for a flight that he estimated would take about 14 hr. Therefore he became lost and oriented considerably and lost but he was watching the ground closely. McCarty found no concrete had no navigation figure the fact would have been a direct indication of the fact of the accident. His recovery from the aircraft was not possible due to the fact that the pilot climbed into the cockpit to ensure ground clearance. Shortly thereafter he gave the message: "At 1,000 ft is the way how to it with a c. Radio will have to get me down." This message indicates that he had almost lost his radio receiver.

### Not IFR Qualified

While Pratt was flying in a very dangerous position. Although the aircraft indicated he had some ground clearance with instrument flight, he should not have been able to cope with existing circumstances. Accord with the fact that he was flying at night but, step speed limit which he was, at his limited instrument experience Pratt was unable to recover.

The Lockheed wreckage and its extensive disintegration pattern suggest following: 1. last step speed. The low level for which followed the crash also suggests that there was a loss of or on fuel left in the Lockheed's tank.

Incidents in all major components of the aircraft were accounted for at the crash site, it is logical to conclude that there was no single failure of the aircraft. Pratt did not see the lights of McCarty as he did not lose them as he descended and a flying blocked space. It is extremely unlikely that he could have seen other lights which he saw, but he saw McCarty in three ways, no change of lights however. Also and McCarty. It is also unlikely that he could have seen the lights of Tinslow. Several Control and Warning Site as it was hidden by a hill. The wreckage (or computer) was substantially as found and the flight theories should not



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